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Passaic Valley Sewerage Commissioners

Passaic Valley Sewerage Commissioners
Response to Request for Information
USEPA, Region 2

Item No. 2.a
PVSC Plan 2.a

Document order #6

Killam

Passaic Valley Sewerage Commissioners
Response to Request for Information
USEPA, Region 2

Co

Item No. 2.a

Final

Quality Assurance/Work Plan
For the Towns of Harrison and Kearny
For the Borough of East Newark and
The City of Paterson

Submitted on behalf of the above municipalities by

Passaic Valley Sewerage Commissioners
Essex County
600 Wilson Avenue
Newark, New Jersey

NJPDES Number NJ0105023

February 1996
Revised July 1997
Revised November 1997
Approved November 30, 1997

946210002

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY
QUALITY ASSURANCE/WORK PLAN
FOR THE TOWNS OF HARRISON AND KEARNY
FOR THE BOROUGH OF EAST NEWARK, AND
THE CITY OF PATERSON

Submitted on behalf of the above municipalities by
Passaic Valley Sewerage Commissioners
Essex County
600 Wilson Avenue
Newark, New Jersey

NJPDES Number NJ0105023
February 29, 1996
(Revised July 24, 1997)
(Revised November 20, 1997)
(Approved November 30, 1997)

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY
QUALITY ASSURANCE/WORK PLAN
FOR THE TOWNS OF HARRISON AND KEARNY,
THE BOROUGH OF EAST NEWARK, AND
THE CITY OF PATERSON

Submitted on behalf of the above municipalities by
Passaic Valley Sewerage Commissioners
Essex County
600 Wilson Avenue
Newark, New Jersey

NJPDES Number NJ0105023

Permittee: ______________________ ________

Robert J. Davenport
Executive Director
Passaic Valley Sewerage Commissioners

Project Officer: ______________________ ________

John S. Rolak Jr., P.E.
Killam Associates

QA Officer: ______________________ ________

Robert A. Albright, Jr., P.E.
Killam Associates

DEP Permits: ______________________ ________

S. Dan Zeppenfeld
NJDEP CSO Coordinator

DEP QA: ______________________ ________

Marc Ferko
NJDEP Office of Quality Assurance

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY
QUALITY ASSURANCE/WORK PLAN
FOR THE TOWNS OF HARRISON AND KEARNY,
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THE CITY OF PATERSON

Submitted on behalf of the above municipalities by
Passaic Valley Sewerage Commissioners
Essex County
600 Wilson Avenue
Newark, New Jersey

NJPDES Number NJ0105023

Permittee: ______________________ __________
Raymond J. McDonough
Mayor
Town of Harrison

Project Officer: ______________________ __________
John S. Rolak Jr., P.E.
Killam Associates

QA Officer: ______________________ __________
Robert A. Albright, Jr., P.E.
Killam Associates

DEP Permits: ______________________ __________
S. Dan Zeppenfeld
NJDEP CSO Coordinator

DEP QA: ______________________ __________
Marc Ferko
NJDEP Office of Quality Assurance

**COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY
QUALITY ASSURANCE/WORK PLAN
FOR THE TOWNS OF HARRISON AND KEARNY,
THE BOROUGH OF EAST NEWARK, AND
THE CITY OF PATERSON**

**Submitted on behalf of the above municipalities by
Passaic Valley Sewerage Commissioners
Essex County
600 Wilson Avenue
Newark, New Jersey**

NJPDES Number NJ0105023

Permittee: ______________________ ________

Leo R. Vartan
Mayor
Town of Kearny

Project Officer: ______________________ ________

John S. Rolak Jr., P.E.
Killam Associates

QA Officer: ______________________ ________

Robert A. Albright, Jr., P.E.
Killam Associates

DEP Permits: ______________________ ________

S. Dan Zeppenfeld
NJDEP CSO Coordinator

DEP QA: ______________________ ________

Marc Ferko
NJDEP Office of Quality Assurance

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY
QUALITY ASSURANCE/WORK PLAN
FOR THE TOWNS OF HARRISON AND KEARNY,
THE BOROUGH OF EAST NEWARK, AND
THE CITY OF PATERSON

Submitted on behalf of the above municipalities by
Passaic Valley Sewerage Commissioners
Essex County
600 Wilson Avenue
Newark, New Jersey

NJPDES Number NJ0105023

Permittee: ______________________ ________
Joseph R. Smith
Mayor
Borough of East Newark

Project Officer: ______________________ ________
John S. Rolak Jr., P.E.
Killam Associates

QA Officer: ______________________ ________
Robert A. Albright, Jr., P.E.
Killam Associates

DEP Permits: ______________________ ________
S. Dan Zeppenfeld
NJDEP CSO Coordinator

DEP QA: ______________________ ________
Marc Ferko
NJDEP Office of Quality Assurance

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY QUALITY ASSURANCE/WORK PLAN FOR THE TOWNS OF HARRISON AND KEARNY, THE BOROUGH OF EAST NEWARK, AND THE CITY OF PATERSON

Submitted on behalf of the above municipalities by
Passaic Valley Sewerage Commissioners
Essex County
600 Wilson Avenue
Newark, New Jersey

NJPDES Number NJ0105023

Permittee: ______________________ ________
Martin G. Barnes
Mayor
City of Paterson

Project Officer: ______________________ ________
John S. Rolak Jr., P.E.
Killam Associates

QA Officer: ______________________ ________
Robert A. Albright, Jr., P.E.
Killam Associates

DEP Permits: ______________________ ________
S. Dan Zeppenfeld
NJDEP CSO Coordinator

DEP QA: ______________________ ________
Marc Ferko
NJDEP Office of Quality Assurance

946210008

1.	**Project Name:**	Combined Sewer Overflow Characterization Study for Kearny, Harrison, East Newark, and Paterson
	Applicant Names:	Passaic Valley Sewerage Commissioners and the Towns of Harrison and Kearny, the Borough of East Newark, and the City of Paterson
	NJPDES Number:	General Permit No. NJ0105023
	Receiving Stream:	Passaic River
2.	**Project Requested By:**	NJPDES Permit No. NJ0105023, Part V.B.4a, 4d, 4e, and 4f
3.	**Date of Request:**	April 1, 1995
4.	**Date of Project Initiation:**	On or about January 1, 1998 Killam Associates shall notify the Department before sampling begins on this project to schedule and perform a field audit of collection techniques.
5.	**Project Officer:**	John S. Rolak Jr., P.E. Killam Associates One Salem Square, Suite 201 West P.O. Box 463 Whitehouse, N.J. 08888 (908) 534-4700
6.	**Quality Assurance Officer:**	Robert A. Albright, Jr., P.E. Killam Associates One Salem Square, Suite 201 West P.O. Box 463 Whitehouse, NJ 08888 (908) 534-4700

7. **Project Description:**

7.1 Goals and Objectives of the Monitoring Program

The project goals and objectives for the monitoring program presented include:

- to develop and/or update site specific dry and wet weather data which can be used to calibrate and verify a SWMM4 model of each CSO drainage basin
- to define the Combined Sewer Systems (CSS's) hydraulic response to rainfall
- to develop current dry weather water quality and quantity data for each CSO drainage basin
- to determine the CSO flows and pollutant concentrations/loadings being discharged to the Passaic River

Additional goals will be established under the Modeling Quality Assurance Work Plan which will define the short term and long term goals of the monitoring and modeling analysis.

A. Objective and Scope Statements

The Passaic Valley Sewerage Commissioners is undertaking a Combined Sewer Overflow Discharge Characterization Study, pursuant to Part V.B., Condition 4a, 4d, 4e, and 4f of NJPDES Permit No. NJ0105023, to provide site specific data which will be used to develop and calibrate SWMM Model(s) of the combined sewer systems within the Towns of Harrison and Kearny, the Borough of East Newark, and the City of Paterson. This Work Plan covers the following segments of the CSO Discharge Characterization Study as specified within the above referenced permit:

a. A Monitoring Program Proposal and Work Plan (this document);

b. A Rainfall Monitoring Study; and

c. A Combined Sewer Overflow Monitoring Study

In accordance with our discussions with the Department, the Quality Assurance / Work Plan for a Combined Sewer System Modeling Study will be submitted separately once the monitoring program has received NJDEP approval.

I. Background Information

The Passaic Valley Sewerage Commissioners (PVSC) provides wastewater treatment service to forty-seven (47) municipalities within their northeast New Jersey service area. The PVSC District covers approximately 150 square miles from Newark Bay to the upper regions of the Passaic River Basin adjacent to the Great Falls in Paterson. The main interceptor sewer of the PVSC, which begins at Prospect Street in Paterson, generally follows the alignment of the Passaic River to the PVSC Water Pollution Control Facility in the City of Newark. The extent of the PVSC Service District and the area combined sewer areas within the study area is illustrated in Figure 1.

Seven (7) of the municipalities within the PVSC District have combined sewer systems and have received Authorization to discharge under the General NJPDES Permit for Combined Sewer Systems. Two of the combined sewer municipalities, the Cities of Bayonne and Jersey City, own and operate their own combined sewer systems, interceptors, CSO Control Facilities, and pumping stations. In addition they jointly own the force main used to transport wastewater to the primary clarifiers at the PVSC treatment plant in Newark. The PVSC does not have any combined sewer overflow control or transportation facilities which service this section of the District. Consequently the Cities of Bayonne and Jersey City will be undertaking their own Characterization Studies.

The other municipalities with combined sewer systems include the Towns of Harrison and Kearny, the Borough of East Newark and the Cities of Newark and Paterson. All of these municipalities are tributary to PVSC interceptors and most of their combined sewer systems are tributary to CSO control facilities owned and/or operated by PVSC. Accordingly PVSC has offered to undertake the CSO Discharge Characterization Study on behalf of the Towns of Harrison and Kearny, the Borough of East Newark, and the Cities of Newark and Paterson. The City of Newark has decided to undertake its own monitoring program and is not included in this Work Plan.

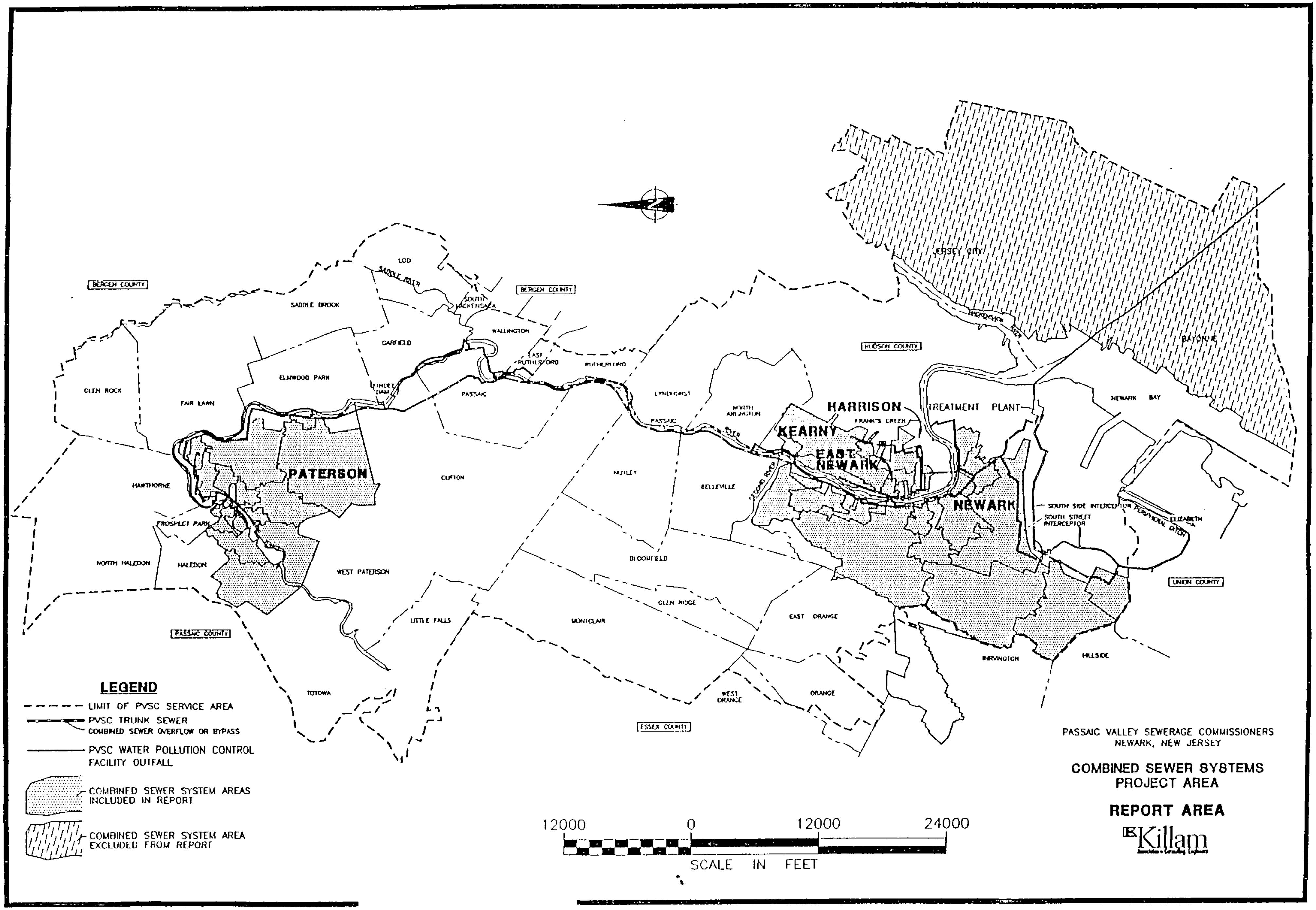

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FIGURE 1

The Passaic Valley Sewerage Commissioners conducted a Phase One Combined Sewer Overflow Analysis for all combined sewer control facilities owned and operated by the PVSC in 1976. This study developed background information on the combined sewer systems tributary to each regulator as well as the analysis of overflow volumes and water quality. Other information which was developed for each combined sewer drainage basin under the 1976 study included:

- the intensity and volume of rainfall which produced CSO discharges;
- the point at which CSOs occur;
- the estimated CSO flow to produce an overflow; and
- the estimated time of concentration (Tc) to the overflow chamber

This information will be updated under the proposed monitoring program.

As an extension of the 1976 study, the PVSC undertook a Combined Sewer Overflow Facility Plan in the early 1980's. The Facility Plan included the development of SWMM 3 Models for the major combined sewer overflow areas and a Dynamic Network Model of the Passaic River. These studies developed an understanding of those combined sewer systems that were then part of the service District and to determine the water quality impact of CSO discharges on the Passaic River. These studies did not include the City of Bayonne nor Jersey City which were not part of the PVSC District at that time.

While the work undertaken in the early 1980's included the development of land side and receiving water models, the procedures and methods used at that time do not fully comply with the present requirements of the General Permit. The information developed under these studies will be used to supplement the present study and will limit the level of effort presently required.

II. Regional Approach

The NJDEP and the Passaic Valley Sewerage Commissioners agree that a cooperative or regional approach to the combined sewer overflow studies and modeling will be the only means of providing meaningful data and analyses. PVSC has, with

NJDEP approval, undertaken coordination and review of Solids and Floatables Control Projects for CSOs within its service district. As an extension to this, PVSC has offered to undertake and coordinate the CSO Discharge Characterization Study for all municipalities tributary to its transport facilities.

A coordination meeting was held with representatives of the combined sewer municipalities tributary to PVSC control and interceptor facilities on February 1, 1996. At that time PVSC indicated its willingness to undertake the CSO Characterization Study on behalf of each municipality. Most municipal representatives indicated a desire for PVSC to undertake this work on their behalf. The exception was the City of Newark, which will complete the monitoring and modeling requirements of their General Permit on their own.

While the City of Newark will undertake the monitoring and modeling of its combined sewer systems on their own, they did request that PVSC continue to undertake the development of detailed system information which is required under the General Permit including the Facilities Inventory, Drainage and Land Use Report and the Sewer System Inventory. The City of Newark has also indicated an interest in PVSC undertaking any receiving water monitoring and modeling required in the future. Newark indicated that they fully intend to conduct a cooperative project wherein they will make the land side SWMM information available to PVSC and their consultants. In this manner PVSC will have access to all the data necessary for inclusion in the next anticipated phase of this project which is the determination of CSO impacts upon the receiving waters.

The following outlines the owner/operators of the CSSs and control facilities included within this Work Plan:

City of Paterson		
	Owner/Operator of CSS	Paterson
	Owner/Operator of Internal Controls	Paterson
	Owner/Operator of Regulators to PVSC Interceptor	PVSC
Town of Harrison		
	Owner of CSS	Harrison
	Operator of CSS	Kearny
	Owner/Operator of Regulators to PVSC Interceptor	PVSC
Town of Kearny		
	Owner/Operator of CSS	Kearny
	Owner/Operator of Regulators to PVSC Interceptor	PVSC
Borough of East Newark		
	Owner of CSS	E. Newark
	Operator of CSS	Kearny
	Owner/Operator of Regulators to PVSC Interceptor	PVSC

Information on the relationship of the CSSs and CSO Points to the entire collection, conveyance, treatment, and effluent disposal facilities is covered in several reports prepared by PVSC under the CSS General Permit and their NJPDES Permit. These include:

- Service Area and Land Use Report for the Towns of Harrison and Kearny, the Borough of East Newark, and the City of Newark and Paterson, dtd Feb 1996
- Sewer System Inventory and Assessment Report for the Towns of Harrison and Kearny, the Borough of East Newark, and the City of Newark and Paterson, dtd Feb 1996
- Maximization of Conveyance of Wastewater to the PVSC Water Pollution Control Facility for Treatment, dtd Dec 1996

Additional information concerning the relationships between the CSSs and the

Transport and Treatment Facilities will be covered in greater detail in the Monitoring and Modeling Report.

III. Purpose

The purpose of the proposed monitoring program is to quantify and qualify dry-weather and wet-weather wastewater flow and pollutant concentration variations at key CSO drainage basins to calibrate and verify hydrologic and hydraulic models (SWMM4) of the combined sewer systems within the Towns of Harrison and Kearny, the Borough of East Newark, and the City of Paterson. This work is the first phase to the development of a mathematical tool which can be used to assess residual storage or hydraulic deficiencies in the collection system, pollutant concentrations and loading distribution in the storm event and among CSO discharge points, pollutant loads to the receiving water, and the development and evaluation of possible long term control alternatives or modifications to the WQS during wet weather events.

This Quality Assurance/Work Plan is being submitted as required by the General Permit for Combined Sewer Systems for the Towns of Kearny and Harrison, the Borough of East Newark, and the City of Paterson. The City of Newark has indicated that it will proceed with the submission of its own Quality Assurance/Work Plan as required under the permit.

The monitoring and modeling study addressed by this work plan, is designed to develop, calibrate and verify a SWMM4 stormwater management model for each of the participating municipalities with CSO systems. The SWMM4 models of the combined sewered areas will produce the hydraulic flow and quality information that will be the basis for projecting wet weather, combined sewage flows, volumes and pollutant loadings to the PVSC interceptor, and ultimately, via the regulator overflows, to the receiving water. The models will permit the evaluation of the interceptor/overflow system response under various hydrologic events of interest, as well as any that would result from CSO management or control actions proposed by the municipalities.

These models will provide the hydraulic input to a model of the PVSC main interceptor which is being developed concurrently under a separate work plan. The Passaic Valley Sewerage Commissioners will shortly initiate a hydraulic modeling effort of the PVSC interceptor system (using SWMM-EXTRAN) to characterize the dynamics of this system and provide the proper hydraulic linkages between the separate SWMM models of the municipal combined sewer areas and the regulators and CSO overflow points. The Work Plan for the interceptor modeling has been developed and reviewed separately.

The overall, comprehensive land-side model that is developed will provide an essential analysis tool for addressing the General Permit requirement for maximization of combined sewer flows to the PVSC wastewater treatment plant in Newark. The land-side model will also provide the hydraulic and water quality data that will provide the necessary inputs for a water quality model of the receiving waters. Although a receiving water model is not presently a requirement of the CSO General Permit, it is anticipated that a suitable model will be required to meet the water quality requirements of the EPA's CSO Control Policy. It is estimated that the work plan for the receiving water model will be developed during 1998, following NJDEP's development of a regional water quality analysis plan.

B. Data Usage

Using the monitored hydrological events and the results of the precipitation statistical analysis, a correlation between rainfall characteristics and the frequency of occurrence that cause a discharge will be established. This data will be used in conjunction with the second task to evaluate the relative loading and flows associated with the discharge from the various control facilities within the region.

Data collection under Part b, A Rainfall Monitoring Study, and Part c, A Combined Sewer Overflow Monitoring Study, will be used to provide input to the Combined Sewer Modeling Study. The measurements of rainfall, flow and quality will have several different uses, and will be analyzed or applied in ways appropriate for the particular use. Specific uses include the following :

Model Calibration/Validation - A primary use of the monitoring data will be for use in first calibrating, and subsequently validating the SWMM model. Adjustment of model coefficients so that the mathematical model provides an adequate representation of the combined sewer areas, will be based on the match between the flows and pollutant concentrations computed by the model, and the observed rainfall, system flows and pollutant concentrations for the storm events examined.

Characterization of CSO Quality - Suitable statistical and other analyses, and appropriate data tabulations will be developed, so that a general characterization of the quality of CSOs in the project area can be produced. Comparison of these results with similar data for other locations - in general, as well as in the NY-NJ harbor area will serve several purposes. These characterizations will provide a basis for assigning appropriate quality characteristics to overflows in the system that are not directly monitored. They will help determine whether there are significant differences in CSO quality for different parts of the harbor area. Comparisons with land use distribution for the various monitored areas will, through planned SWMM sensitivity analyses, help determine the most appropriate quality routine to use in the model runs (e.g., dust and dirt buildup-washoff versus alternative quality routines).

Rainfall Event Characterization - The statistical analysis of area rainfall will be made shortly after the Work Plan is approved. While the analysis will be based upon information obtained for Newark Airport, NOAA records for other gages in the area (e.g., Rahway, Little Falls, Springfield, and Essex Fells) will be incorporate in the analysis to establish rain stats for the overall study area. Storm event characteristics (volume, intensity, duration) for the individual storms associated with CSO monitoring events, and for the aggregate of all monitored storms, will be compared with long term statistics for area rainfall to determine the return period for the monitored storm and the anticipated probability of occurrence within the region.

The plan is to mobilize for wet weather monitoring for storms predicted to be 0.5 to

1.0 inch in volume since these storms events should result in combined sewer overflows. A preliminary statistical analysis of rainfall at Newark Airport indicates that approximately 55 percent of storms have rainfall volumes equal or less than 0.50 inches while 80 percent of storms have rainfall volumes equal or less than 1.0 inches. We should bear in mind however that a representative set of monitored events should include a variety of sized storms since all storm events are possible. In addition, other precipitation factors such as peak rainfall intensity, duration, and the timing of the rainfall event could also have a considerable impact on whether an overflow event occurs. Storm events that fall outside of the target range are still relevant, and therefore data collected from all rainfall events will be presented in the monitoring report. The elimination of an overflow event because it does not fit within artificially established guidelines could introduce a bias to the data and result in the model not being truly representative of the area. The intent is to sample within the parameters established, however the presence of smaller or larger storms will be considered acceptable.

Rainfall-Overflow Correlation Analysis - Analysis will be made using the monitored hydrological events and the results of the precipitation statistical analysis, to develop the correlation between the characteristics and frequency of occurrence of rainfall events that cause a discharge. This data will be useful for conducting screening analyses for a variety of purposes, such as for example, to evaluate the relative loading and flows associated with the discharge from the various control facilities within the region.

C. Monitoring Network Design and Rational

I. Design

The monitoring requirements for this study are divided into two tasks: the development of information under the Rainfall Monitoring Study, and the development and monitoring of storm events under the Combined Sewer Overflow Monitoring Study. Both tasks will be discussed separately within the Work Plan.

a. Rainfall

The first task to be completed under the Work Plan will be to evaluate the relationship between rainfall, and the conditions which produce combined sewer overflows within the region. A historical precipitation analysis will be conducted which at a minimum includes the evaluation of climatological records and the determination of historic and measured rainfall events statistics. Previous studies undertaken by PVSC in the region showed a marked difference between the rainfall duration, intensities, and volumes in the areas around Paterson and Newark. The long term precipitation records of Newark and Little Falls will therefore be analyzed to develop an understanding of rainfall intensities, volumes, and durations experienced within each of the combined sewer system regions.

As part of the rainfall monitoring study, a rain gage network shall be established within the study area and maintained throughout the monitoring period. As indicated, PVSC has undertaken previous investigations of the combined sewer systems within its district including the development of mathematical models of the drainage basins and Passaic River. As part of the work undertaken in the early 1980's, a rainfall network of six (6) rain gage stations was established and maintained for a period of approximately two years.

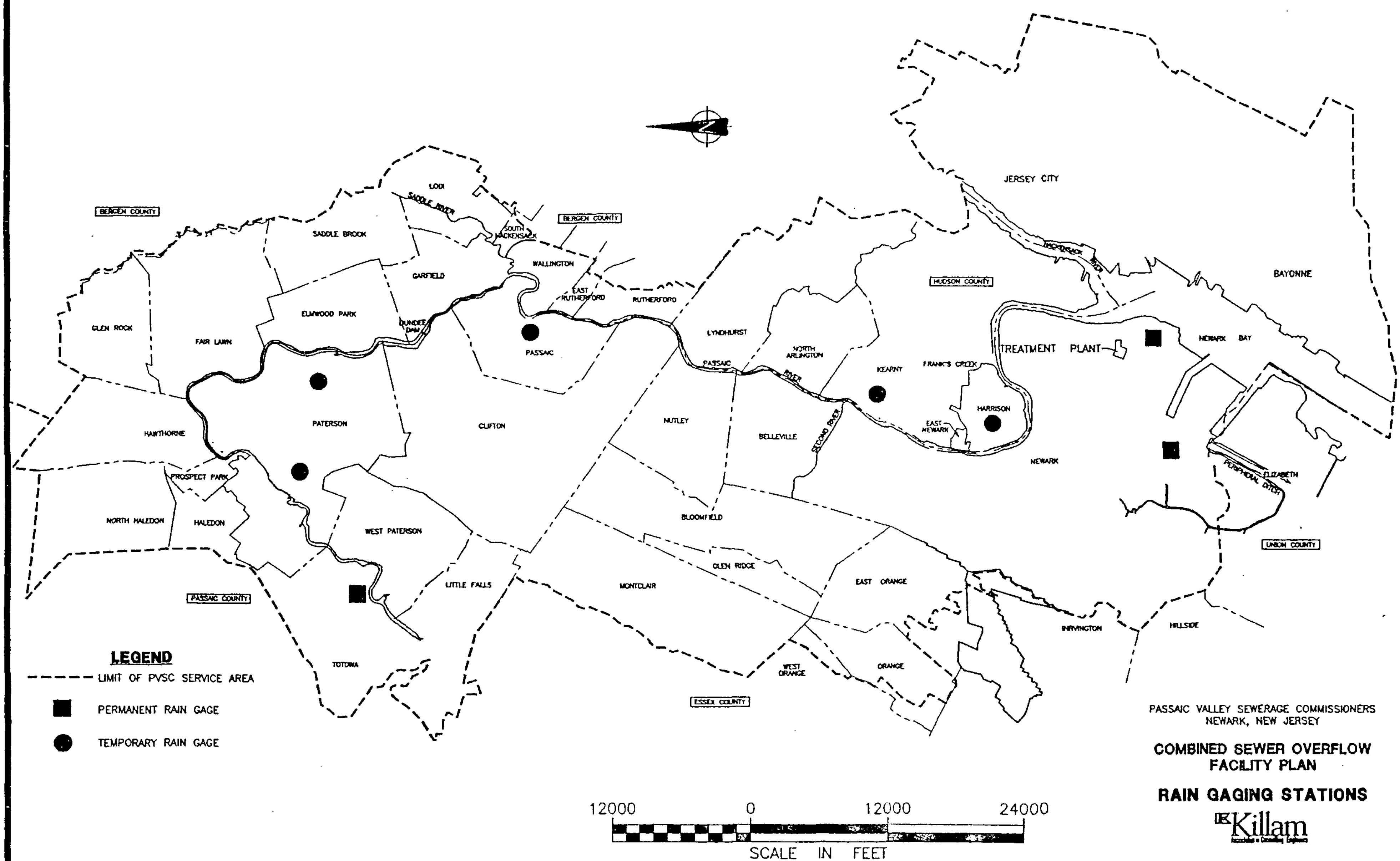
Each temporary gaging station established under this monitoring program will be equipped with an ISCO Model 674-L tipping bucket logging rain gage with an 8-inch diameter tipping bucket and a Model 948 Data Transfer Unit. Rainfall intensities shall be measured in 0.01 inch increments and logged at ten (10) minute intervals. Units will be placed in locations which are open and free from outside influences such as trees or areas surrounded by tall buildings. The rainfall gage at PVSC is a Belfort Model 5-405 tipping bucket rain gage which also records precipitation in 0.01 inch increments. Signals from this rain gage are collected by computer and monitored continuously at 10 minute intervals.

It should be recognized that there are a number of existing (high quality/long term) rain gages that should also be part of the network. These include the NOAA gages at Newark Airport and in Little Falls both of which record hourly total rainfall. While the type of gage, monitoring intervals, and specific location for these sites are out of the direct control of our program, they will enhance our ability to estimate spatial rain distribution and are the only source of long term rainfall information for continuous simulations during historically critical periods. Accordingly, these gages will be used to supplement, as deemed necessary by experience, the temporary rain gages established under this program. All data utilized and or adjusted will be documented and substantiated in the modeling report.

The proposed rain gage network will include three permanent and five temporary rain gage stations as follows:

City of Newark	NOAA Station at Newark Airport (permanent)	
PVSC	Permanent Rain Gage at WPCF	
Little Falls	NOAA Station at PVWC	
Town of Kearny	Temporary Rain Gage at Police Department Building Corner of Forest and Laurel	Gage #1
Town of Harrison	Temporary Rain Gage at Fire Department Headquarters 7th Street and Wilhelm Street	Gage #2
City of Passaic	Temporary Rain Gage at PVSC Wallington Pumping Station	Gage #3
City of Paterson	Temporary Rain Gage at Madison Fire Station 850 Madison Avenue	Gage #4
City of Paterson	Temporary Rain Gage at Stanley Levine Reservoir Grand Street	Gage #5

The proposed rain gage distribution for this project is illustrated on Figure 2. In addition, the precise location of each temporary rain gage is illustrated in Figures



PASSAIC VALLEY SEWERAGE COMMISSIONERS
NEWARK, NEW JERSEY

COMBINED SEWER OVERFLOW FACILITY PLAN

RAIN GAGING STATIONS

Killam

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FIGURE 2

2a through 2e. A rain gage station will not be established in the City of Newark which will undertake its own study.

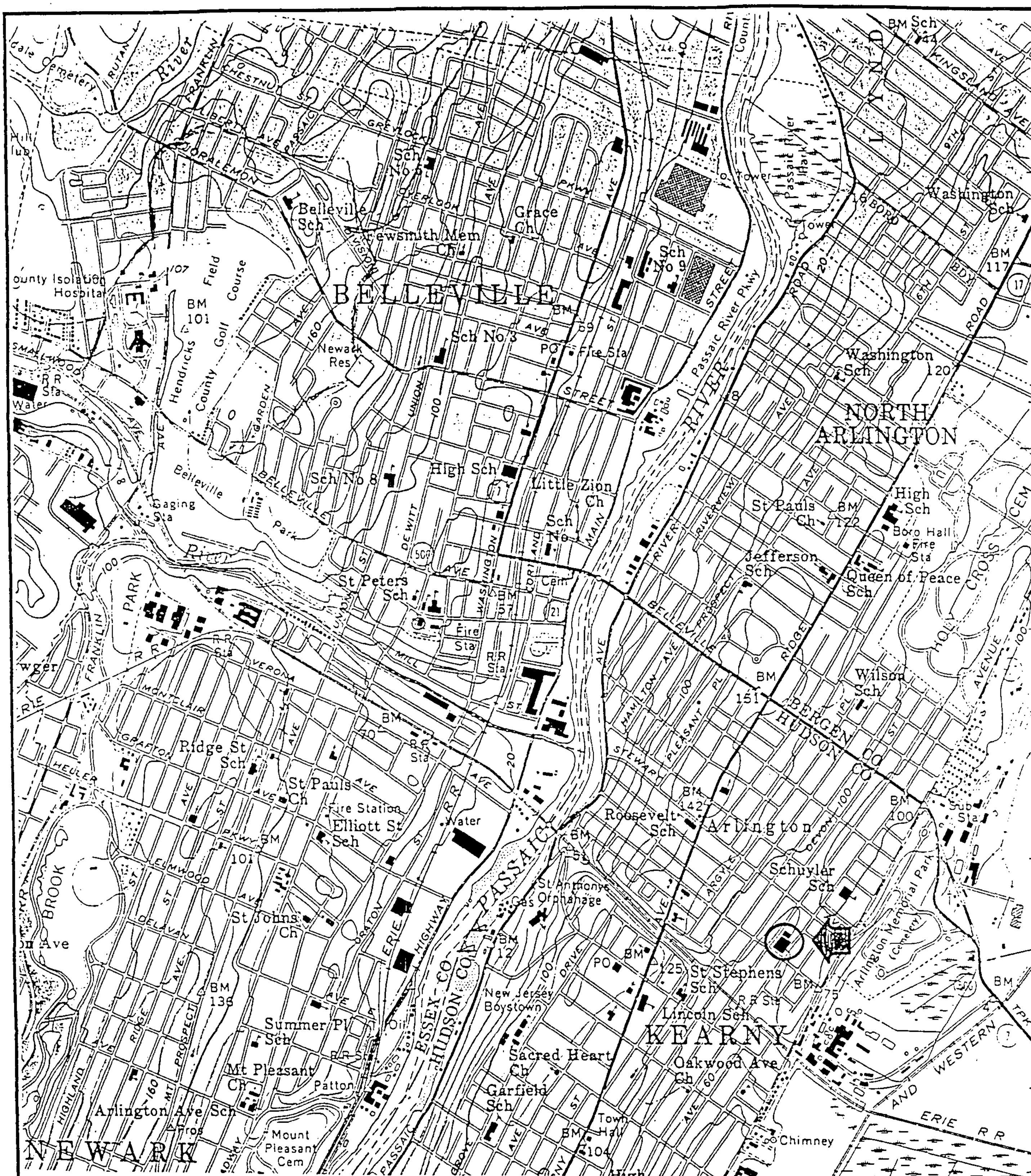
The proposed rain gage network will provide complete information upon the rainfall volumes and intensities which develop throughout the PVSC District. The temporary gages in Passaic will provide valuable information upon the relationship of rainfall characteristics within separate sanitary sewer areas located between the combined sewer systems of Paterson and Newark. It will be important to be able to use data from the rain monitoring effort to provide information on "storm tracks" for use when projection runs are made. With the 30 mile length of the interceptor and travel times on the order of half a day, the patterns for CSO overflows could be significantly different for storms that track "up the system" versus those that move down or across. The proposed network of rain gages, in association with the existing permanent gages, will provide data for examining this issue and will afford important detail on the spatial distribution of rainfall over the large study area. This information will be essential in the development of wet weather sanitary sewage inputs for both the interceptor model, which will be covered under a separate Work Plan, and the receiving water monitoring and modeling which is anticipated will be required and completed in the near future.

b. Characterization of Combined Sewer Systems

The second task to be completed under this Work Plan will be flow and water quality monitoring of all combined sewer drainage basins under dry weather conditions, and selected combined sewer control facilities during periods of rainfall. Each will be described in detail in the following sections.

i. Monitoring of Background Conditions

The first phase of flow and water quality monitoring will be conducted to assess the background, dry weather flow quality and quantity at each of the forty-two CSO drainage basins being monitored under this program. Flow



2000 0 2000 4000

SCALE IN FEET

NOTE: TAKEN FROM USGS ORANGE, N.J. QUADRANGLE DATED 1955

PASSAIC VALLEY SEWERAGE COMMISSIONERS

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY

TEMPORARY NO. 1 RAIN GAGE
TOWN OF KEARNY
POLICE STATION

Killam

FIGURE 2A

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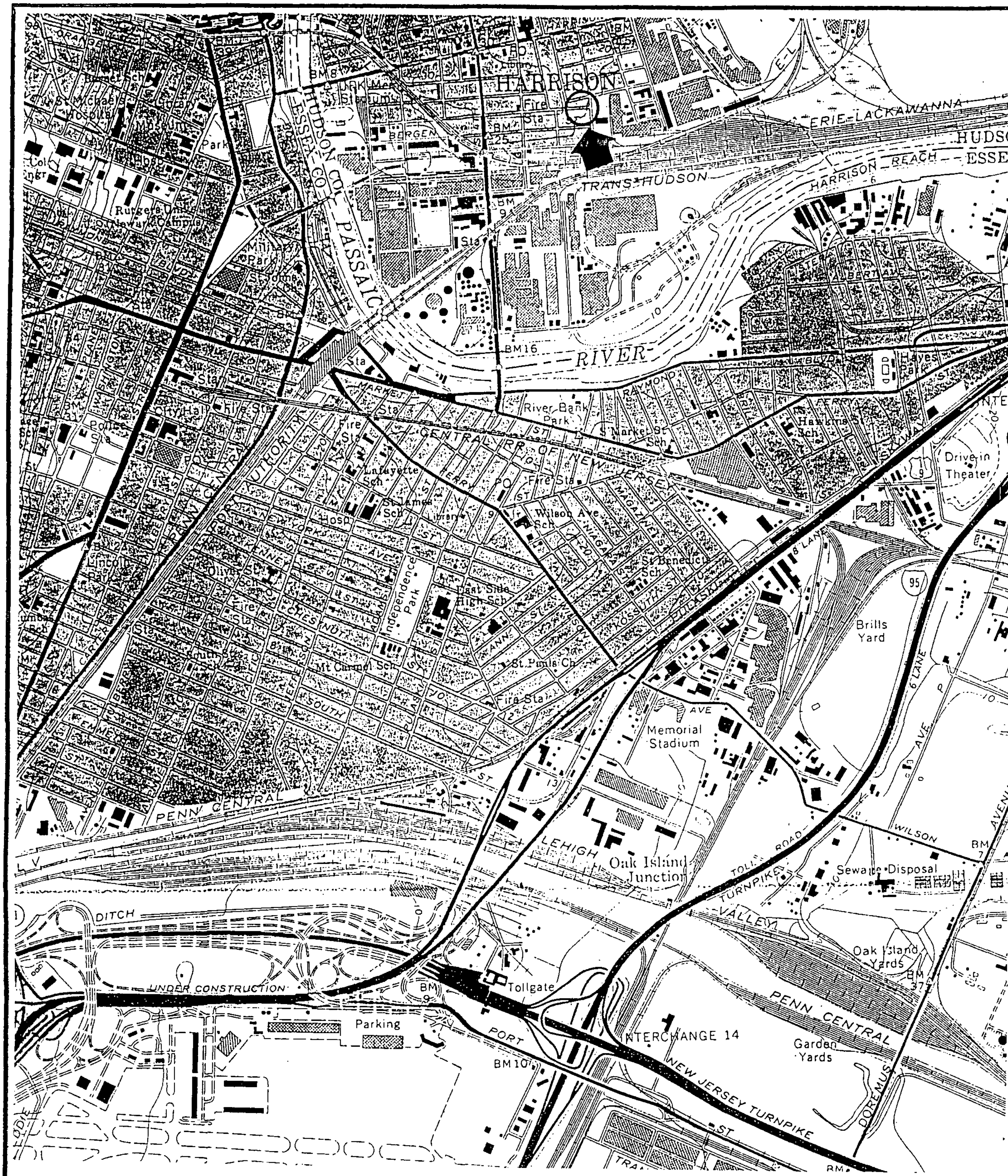

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SCALE IN FEET

NOTE: TAKEN FROM USGS ELIZABETH, N.J. QUADRANGLE DATED 1967

PASSAIC VALLEY SEWERAGE COMMISSIONERS
COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY
TEMPORARY NO. 2 RAIN GAGE
TOWN OF HARRISON
FIRE DEPARTMENT HEADQUARTERS
Killam
FIGURE 2B

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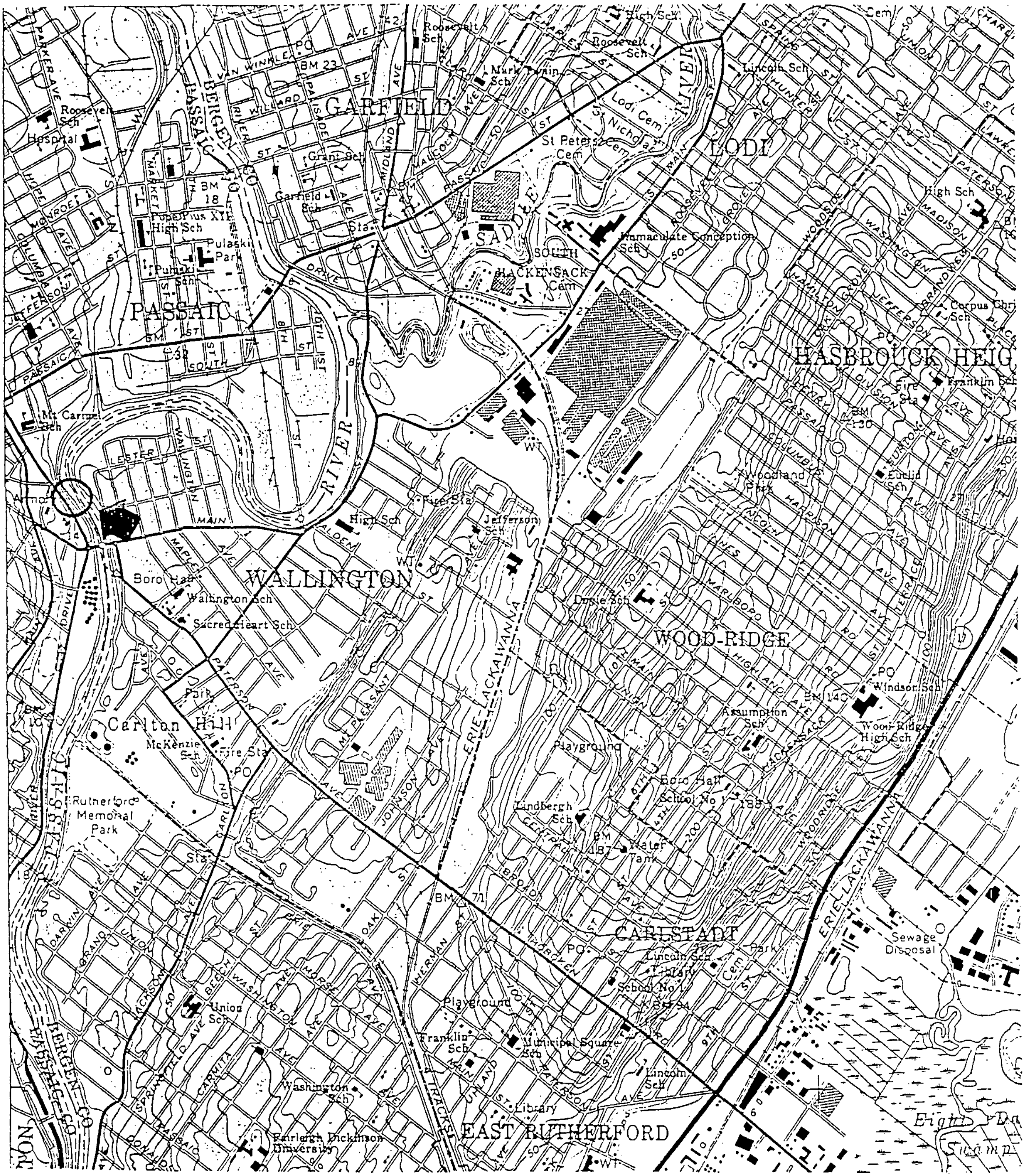

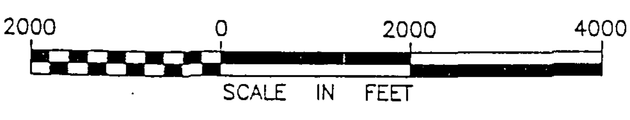

NOTE: TAKEN FROM USGS WEEHAWKEN, N.J.–N.Y. QUADRANGLE DATED 1967

PASSAIC VALLEY SEWERAGE COMMISSIONERS

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY

TEMPORARY NO. 3 RAIN GAGE

CITY OF PASSAIC

PVSC WALLINGTON SEWAGE PUMPING STATION

Killam

FIGURE 2C

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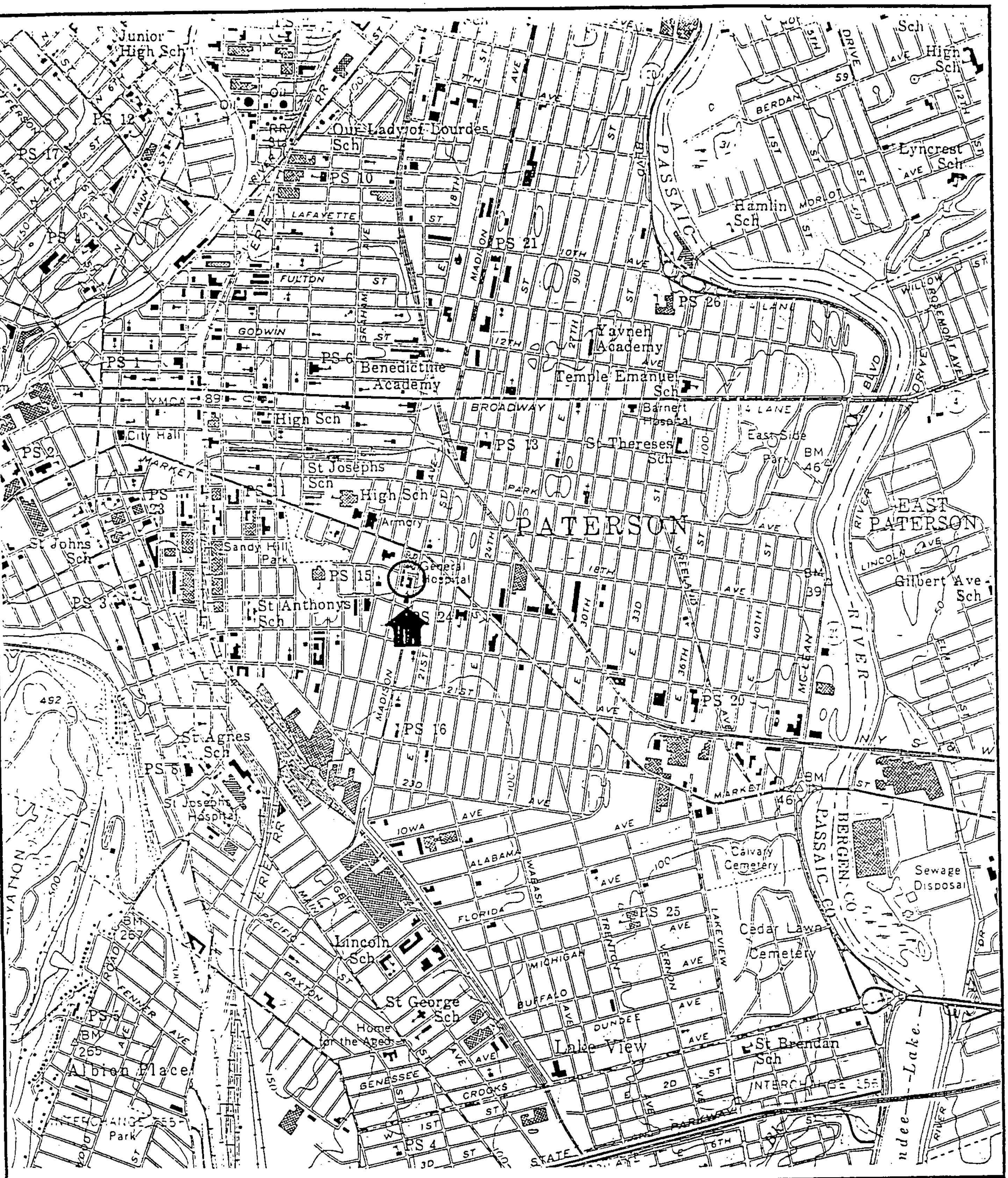

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SCALE IN FEET

NOTE: TAKEN FROM USGS PATERSON, N.J. QUADRANGLE DATED 1955

PASSAIC VALLEY SEWERAGE COMMISSIONERS

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY

TEMPORARY NO. 4 RAIN GAGE

CITY OF PATERSON

MADISON FIRE STATION

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FIGURE 2D

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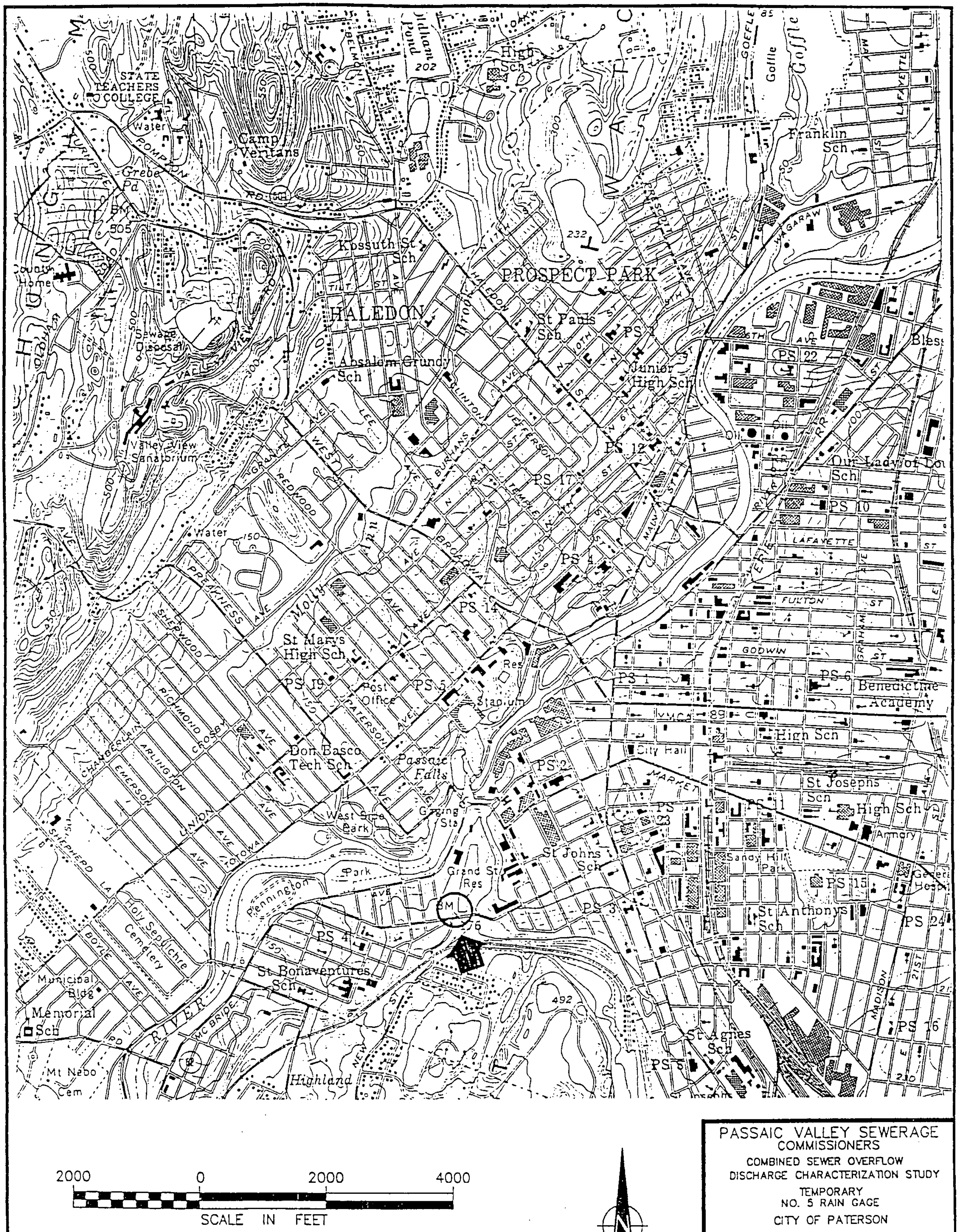

NOTE: TAKEN FROM USGS PATERSON, N.J. QUADRANGLE DATED 1955

PASSAIC VALLEY SEWERAGE COMMISSIONERS

COMBINED SEWER OVERFLOW DISCHARGE CHARACTERIZATION STUDY

TEMPORARY NO. 5 RAIN GAGE

CITY OF PATERSON

STANLEY LEVINE RESERVOIR

Killam

FIGURE 2E

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monitoring will, in general, be conducted in groups of six to eight drainage basins within the same municipality. Flow meters will be installed at the inlet to the PVSC CSO Control Facility or at the first acceptable manhole upstream and will be maintained for a minimum period of four weeks. The metering locations for each drainage basin is provided on mapping located in the rear of the Plan as Plates 1 thru 10.

In addition to the baseline flow monitoring to be conducted at each of the forty-two drainage basins included within this Work Plan, additional flow metering will also be conducted at two major drainage basins in the City of Paterson, Market Street and Curtis Place. The City of Paterson has over the years developed a relief sewer system to provide hydraulic relief to the combined sewer system. Accordingly the City has approximately twenty internal overflow locations in three drainage basins. To adequately model these drainage basins it will be necessary to develop additional flow information. Hence, Market Street and Curtis Place will have additional meters monitoring flow during the one month baseline monitoring period, while Montgomery Street (Loop Road) will be monitored during the wet weather overflow events. Maps illustrating the locations of internal metering locations for Curtis Place and Market Street are provided in the rear of this Work Plan as Plates A and B.

Dry weather water quality data will also be generated for each drainage basin during the one month monitoring period. Two flow composite sample will be developed over twenty-four hour periods and analyzed for the following parameters, provided the drainage basin has adequate dry weather flow: TSS, BOD5, COD, TDS, TH, NH3, TKN, NO2+3, Ortho P, Total P and settleable solids. Monitoring for fecal coliforms, pH, and Temperature will be described later.

In order to eliminate the impact of runoff and rainfall induced infiltration from the baseline water quality data, the water quality sampling for baseline monitoring at each CSO drainage basin will be:

- Conducted only during dry weather, that is, following a minimum of three days of no precipitation following a rainfall exceeding 0.25 inches, or two days of no precipitation following rainfall less than 0.25 inches, or one day of no precipitation following rainfall if metering data indicates that there is little or no rainfall induced infiltration in the drainage basin; and

- Will be completed during the work week defined as Monday through Friday excluding holidays.

In addition to the composite samples, discrete grab sample will be collected for fecal coliforms, and field measurements for temperature, and pH will be conducted randomly at each site during the one month background monitoring period. Sample collection and field measurements will be conducted so that periods of monitoring will not occur during the same general time of day or the day of the week. Fecal coliforms, temperature, and pH monitoring may be conducted during meter installation, meter servicing, setup or collection of water quality composite samples, meter removal, or random times during the project period. All monitoring sites will be monitored for fecal coliform, pH, and temperature on at least four different occasions.

ii. Wet Weather Monitoring

The study area includes forty-two individual CSO drainage basins in four separate municipalities and two different geographical areas. To minimize the number of locations which needed to be monitored during wet weather, a screening was conducted to group the forty-two CSO drainage basins by land use and to choose monitoring locations with good monitoring characteristics and adequate overflow events. Table 1 provides information on the screening process as well the monitoring locations which could be utilized if the monitoring sites are chosen on land use characteristics. Overall, approximately 45 percent of the total drainage area is monitored under this criterion.

A secondary screening was completed based on anticipated pollutant loads being generated by each drainage area. The analysis which is provided as Table 2 indicates that eight drainage basins account for approximately seventy-five percent of the drainage area and BOD loads discharged to the Passaic River. In addition, a review of significant non-residential users showed that the proposed monitoring locations will include approximately 65% of the flow from significant non-residential users and the remaining 35% was primarily located in areas with separate storm sewers. In the Harrison, Kearny, East Newark Area the proposed monitoring locations account for approximately 69% of the significant non-residential users.

The wet weather monitoring sites were therefore established based on the pollutant load analysis with the exception of Central Avenue in East Newark. The Borough of East Newark has indicated a desire to separate its combined sewer system and to eliminate the CSO discharge from their municipality. The NJDEP has therefore requested that Central Avenue will be monitored for flow during wet weather events to establish flow patterns which can be used by the NJDEP to evaluate the potential impact of sewer separation.

A review of the Land Use Breakdown vs Proposed Monitoring Locations is provided in Table 3. The table shows that three land use groups will not be represented in the proposed monitoring locations. These include relatively small drainage basins which are 85% or more residential, completely industrial, and completely commercial. A review of these areas indicate that the industrial areas are, for the most part, serviced by separate storm sewers

Table 1
Percentage of Total Area to Land Use Noted
Sorted by Residential, Industrial, Commercial, & Open Space Order

Municipality	P Number	Sub Area	Overflow Name	Total Acres	Percent Impervious	R1	R2	R3	Total Resident	Industrial	Commercial	Open Space
Kearny	1		Stewart St.	39	54%		100		100			
Kearny	2		Washington St.	10	54%		100		100			
Paterson	22	C	Short St	46	61%		100		100			
Paterson	14		E.12th St. & 4th A	25	68%		100		100			
Paterson	21		Bergen St	5	51%		100		100			
Harrison	2		Cleveland Ave.	16	59%		100		100			
Kearny	10		Dukes St.	18	54%		100		100			
Paterson		B1&B2	Hudson St.	148		1	91		92	7		1
Harrison	3	A	Harrison Ave.	84	70%		89		89		11	
Kearny	9		Tappan St.	54	52%		81		81	19		
Paterson	26	U	20th Ave.	62	52%		79		79	21		
Paterson	24	N	3rd Ave.	66	75%		76		76	24		
Kearny	6	B	Johnston St.	250			79		79	3	12	6
Paterson	25	R&S	Tenth Ave. & 33rd	694		0	79		79	9	8	4
Paterson	16	B1	Northwest St.	242			75		75	3	20	2
Paterson	7	G1,G2	Straight St	112	61%		74		74	14	12	
Paterson	1	A1	Curtis Pl.	774			72		72	5	2	21
Paterson	15	A2	SUM Park	47	43%		72		72			28
Paterson	13		E. 11st Street	103	71%		71		71	29		
Paterson	23	Y	2nd Ave.	26	79%		65		65	35		
Paterson	27	V!&V2	Market St.	1188		0	64		64	29	6	2
Kearny	4	B	Nairn St.	157	48%	18	36	8	62	13		25
Harrison	6		Bergen St.	38	80%		24	34	58	42		
Harrison	1		Hamilton St.	7	38%		57		57			43
Paterson	5		Bridge St	15	68%			53	53	47		
Paterson	9	H	Keen Street	17	59%		53		53	47		
Paterson	10	CC	Warren St.	104	70%		49		49	51		
Kearny	8		Bergen Ave.	110	49%		49		49	43		8
Kearny	7	C	Ivy St.	831			48		48	19	16	17
Harrison	7	A	Worthington Ave.	208	56%	0	41	3	44	28	4	24
East Newark	1	A	Central Avenue	55	77%		42		42	58		
Paterson	6	F	Montgomery St.	374			37		37	30	27	
Kearny	5		Marshall St	19	67%		21		21	79		
Harrison	5	A	Middlesex St.	64	86%				0	100		
Harrison	4		Dey St.	2	99%				0	100		
Paterson	11	J	6th Ave.	41	69%				0	100		
Paterson	8		Franklin Street	2					0	100		
Paterson	12	K	5th St. & 5th Ave.	8	69%				0	100		
Paterson	3		West Broadway	4	83%				0		100	
Paterson	4		Bank St.	1.5	83%				0		100	
Paterson	2		Mulberry St.	2	76%				0		100	
				6,069								

Acres Monitored vs Total Acres 45%

Possible Monitoring Locations $\boxed{}$

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Table 2
Wet Weather Monitoring Locations
Based on BOD Loading

Municipality	P Number	Sub Area	Overflow Name	Total Acres	R1	R2	R3	Total Resident	Open Space	Industrial	Commercial	BOD Rank
Paterson	27	V!&V2	Market St.	1188	0	64		64	2	29	6	1179
Kearny	7	C	Ivy St.	831		48		48	17	19	16	702
Paterson	25	R&S	Tenth Ave. & 33r	694	0	79		79	4	9	8	604
Paterson	1	A1	Curtis Pl	774		72		72	21	5	2	533
Paterson	6	F	Montgomery St.	374		37		37		30	27	386
Paterson	16	B1	Northwest St.	242		75		75	2	3	20	216
Kearny	6	B	Johnston St.	250		79		79	6	3	12	209
Harrison	7	A	Worthington Ave.	208	0	41	3	44	24	28	4	166
Paterson		B1&B2	Hudson St.	148	1	91		92	1	7		127
Paterson	10	CC	Warren St.	104		49		49		51		115
Kearny	8		Bergen Ave.	110		49		49	8	43		110
Kearny	4	B	Nairn St.	157	18	36	8	62	25	13		109
Paterson	7	G1,G2	Straight St	112		74		74		14	12	106
Paterson	13		E. 11st Street	103		71		71		29		102
Harrison	5	A	Middlesex St.	64				0		100		88
Harrison	3	A	Harrison Ave.	84		89		89			11	73
Paterson	24	N	3rd Ave.	66		76		76		24		63
East Newark	1	A	Central Avenue	55		42		42		58		63
Paterson	26	U	20th Ave.	62		79		79		21		59
Paterson	11	J	6th Ave.	41				0		100		57
Kearny	9		Tappan St.	54		81		81		19		50
Harrison	6		Bergen St.	38		24	34	58		42		40
Paterson	22	C	Short St	46		100		100				38
Kearny	1		Stewart St.	39		100		100				32
Paterson	15	A2	SUM Park	47		72		72	28			28
Paterson	23	Y	2nd Ave.	26		65		65		35		27
Kearny	5		Marshall St	19		21		21		79		24
Paterson	14		E.12th St. & 4th	25		100		100				21
Paterson	9	H	Keen Street	17		53		53		47		18
Paterson	5		Bridge St	15			53	53		47		16
Kearny	10		Dukes St.	18		100		100				15
Harrison	2		Cleveland Ave.	16		100		100				13
Paterson	12	K	5th St. & 5th Ave.	8				0		100		11
Kearny	2		Washington St.	10		100		100				8
Paterson	3		West Broadway	4				0			100	5
Paterson	21		Bergen St	5		100		100				4
Harrison	1		Hamilton St.	7		57		57	43			3
Paterson	8		Franklin Street	2				0		100		3
Harrison	4		Dey St.	2				0		100		3
Paterson	2		Mulberry St.	2				0			100	2
Paterson	4		Bank St.	1.5				0			100	2
Kearny	3		Bergen Ave.	12				0				0

Total Area to be Monitored	4616
Total Area in Regional Study	6069
Percentage of Area Covered	76%

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and the commercial areas are fringe drainage basins with extreme small tributary areas. Overall 92% of the land use groups will be represented by one or more monitoring locations under the proposed plan. The remaining 8% fall within three basic land use types and will be modeled using literature valves for pollutant load characteristics. Overall it is anticipated that this procedure will provide the maximum utilization of real time data while reducing the overall effort in small drainage basins.

The wet weather characterization of CSO discharges in the study area will be developed by monitoring three (3) to four (4) separate storm events at eleven (11) combined sewer overflow control facilities representing eight separate drainage basins within the study area. Because of the distances between the two spatial clusters of monitoring sites and the number of individual monitoring locations, the sampling will be conducted during three separate periods. The first period will include the monitoring of four locations within the Kearny, East Newark, Harrison area as one group; the second and third periods will be used in the monitoring of seven locations in the Paterson area. Monitoring of CSO control facilities will only be scheduled when rainfall is predicted in the 0.5 to 1.0 inch range. The actual amount of rainfall received during the monitoring period can not be controlled and will thus be left to nature. All water quality samples obtained will be analyzed and evaluated for input into the model. It is anticipated that at least one event will be required for calibration of the SWMM model and one for verification. The monitoring of storm events is anticipated to start in the spring of 1998 and is estimated will take approximately fifteen months to complete.

Wet Weather Monitoring Site Locations :

The wet weather flow and water quality sampling conducted under this program will include eight (8) of the forty-two (42) combined sewer overflow drainage basins tributary to the Passaic Valley Sewerage Commissioners interceptor system within the municipalities of Kearny, East Newark, Harrison and Paterson. In addition flow monitoring will be conducted at one additional drainage basin which represents the entire flow from the Borough of East Newark. As previously indicated, the City of Newark shall establish its own Work Plan and monitoring program. The eight drainage basins being monitored for both flow quality and quantity represent the largest BOD loads from combined sewer systems in the study area and cover a total area of approximately 4,600 acres, or over three quarters of the land area within the study area. The data collected from these eight (8) drainage basins will be used to develop information on the loading from the other CSO basins within the study area in accordance with Table 3.

In addition to the eight (8) combined sewer control regulators owned and operated by the PVSC, the Market Street and Montgomery Street drainage basins include major control structures owned and operated by the City of Paterson. An overflow weir at Vreeland and 19th Avenue bypasses the Market Street Regulator and can create a major overflow discharge to the 19th Avenue Relief Sewer. In addition, several major overflow weirs along the Montgomery collector sewers can create a major overflow discharge(s) to the Loop Road Relief Sewer. Both of these sites will also be monitored, providing a total of eleven (11) monitoring locations that will be used to develop the information base necessary for characterizing the area's CSOs, and for the calibration and verification of SWMM. The proposed monitoring locations are illustrated on Plates 1 thru 10 located in the rear of the report. Each wet weather monitoring location is designated with a triangular symbol. All proposed monitoring locations have been reviewed in the field by NJDEP personnel and as such are expected to be acceptable for monitoring.

The eleven (11) wet weather monitoring locations proposed under this Work Plan are illustrated in Figure 3 and include the following:

Table 3
Land Use Breakdown vs. Proposed Monitoring Locations
Sorted by Residential, Industrial, Commercial, & Open Space Order

Municipality	P Number	Sub Area	Overflow Name	Total Acres	Percent Impervious	R1	R2	R3	Total Resident	Industrial	Commercial	Open Space
Kearny	1		Stewart St.	39	54%		100		100			
Kearny	2		Washington St.	10	54%		100		100			
Paterson	22	C	Short St	46	61%		100		100			
Paterson	14		E.12th St. & 4th A	25	68%		100		100			
Paterson	21		Bergen St	5	51%		100		100			
Harrison	2		Cleveland Ave.	16	59%		100		100			
Kearny	10		Dukes St.	18	54%		100		100			
Paterson		B1&B2	Hudson St.	148		1	91		92	7		1
Harrison	3	A	Harrison Ave.	84	70%		89		89		11	
Kearny	9		Tappan St.	54	52%		81		81	19		
Paterson	26	U	20th Ave.	62	52%		79		79	21		
Paterson	24	N	3rd Ave.	66	75%		76		76	24		
Kearny	6	B	Johnston St.	250			79		79	3	12	6
Paterson	25	R&S	Tenth Ave. & 33rd	694		0	79		79	9	8	4
Paterson	16	B1	Northwest St.	242			75		75	3	20	2
Paterson	7	G1,G2	Straight St	112	61%		74		74	14	12	
Paterson	1	A1	Curtis Pl.	774			72		72	5	2	21
Paterson	15	A2	SUM Park	47	43%		72		72			28
Paterson	13		E. 11st Street	103	71%		71		71	29		
Paterson	23	Y	2nd Ave.	26	79%		65		65	35		
Paterson	27	V!&V2	Market St.	1188		0	64		64	29	6	2
Kearny	4	B	Nairn St.	157	48%	18	36	8	62	13		25
Harrison	6		Bergen St.	38	80%		24	34	58	42		
Harrison	1		Hamilton St.	7	38%		57		57			43
Paterson	5		Bridge St	15	68%			53	53	47		
Paterson	9	H	Keen Street	17	59%		53		53	47		
Paterson	10	CC	Warren St.	104	70%		49		49	51		
Kearny	8		Bergen Ave.	110	49%		49		49	43		8
Kearny	7	C	Ivy St.	831			48		48	19	16	17
Harrison	7	A	Worthington Ave.	208	56%	0	41	3	44	28	4	24
East Newark	1	A	Central Avenue	55	77%		42		42	58		
Paterson	6	F	Montgomery St.	374			37		37	30	27	
Kearny	5		Marshall St	19	67%		21		21	79		
Harrison	5	A	Middlesex St.	64	86%				0	100		
Harrison	4		Dey St.	2	99%				0	100		
Paterson	11	J	6th Ave.	41	69%				0	100		
Paterson	8		Franklin Street	2					0	100		
Paterson	12	K	5th St. & 5th Ave.	8	69%				0	100		
Paterson	3		West Broadway	4	83%				0		100	
Paterson	4		Bank St.	1.5	83%				0		100	
Paterson	2		Mulberry St.	2	76%				0		100	
			Total Area	6,069								

Acres Monitored vs Total Acres 75%
Land Use Groups Monitored vs Total Acres 92%

Proposed Monitoring Locations

Drainage Basin	*Monitoring Site*
In the City of Paterson	
Market Street	PVSC Regulator
	19^{th} Avenue Relief Sewer
10th Ave & 33rd St	PVSC Regulator
Curtis Place	PVSC Regulator
Montgomery Street	PVSC Regulator
	Loop Road Relief Sewer
Northwest Street	PVSC Regulator
In the Town of Kearny	
Ivy Street	PVSC Regulator
Johnston Street	PVSC Regulator
In the Town of Harrison	
Worthington Avenue	PVSC Regulator
In the Borough of East Newark	Central Avenue (Flow only)

Sampling Procedure :

Wet weather monitoring at each of the eleven (11) proposed CSO monitoring stations will be conducted in accordance with the following description:

To capture the first flush condition, monitoring and sampling equipment will be installed in the sandcatcher chamber of each control facility prior to or shortly after the commencement of a storm event, but prior to the start of an overflow. A sensing probe will be installed at the height of the weir to initiate operation of the automatic sampler once an overflow event commences. At the same time, the flow monitoring equipment (SIGMA

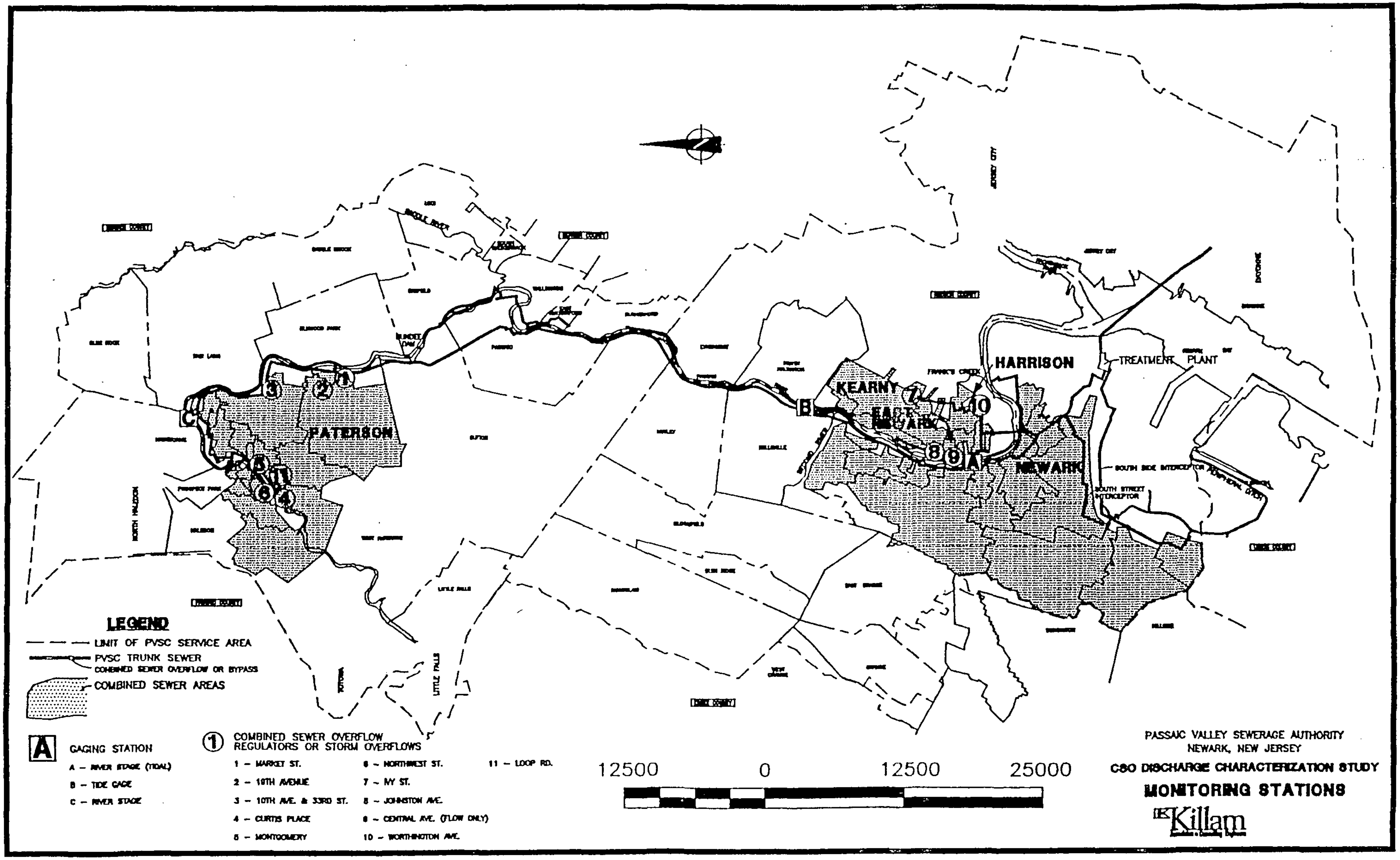

Figure 3

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Model 950 AV) will monitor the height of water overflowing the weir by means of a bubbler or the depth and velocity of flow exiting through the overflow pipe by means of a doppler meter. Where feasible the overflow rate will be monitored in the discharge pipe however where access to the discharge pipe is not available, overflow rates will be based on the measured height of flow over the weir and weir capacity curves.

Water quality sampling at each control facility will commence with the start of an overflow event and continue for a maximum of seven (7) hours. Only a single sampling point will be established at each control facility (monitoring station) since adequate in-system mixing should occur during rainfall events. Monitoring will be conducted in the sandcatcher to monitor the loads that develop and overflow from the PVSC system as operated. The sandcatcher is a standard part of the PVSC regulator design, and essentially all PVSC regulators have them. Any potential pollutant loads developing within the sandcatcher must be included to develop a realistic evaluation of the pollutant loads existing the discharge pipe. While it anticipated that any impact from the accumulation of organics in the sandcatcher will be short term, the planned 15 minute sampling schedule for TSS and BOD should provide information on whether there is a deposition/resuspension situation at the regulators.

Samples for water quality will be collected by both automatic samplers, and by means of manual grab samples for those water quality parameters that require this procedure or that call for immediate field analysis following collection. The proposed sample collection matrix for this project is illustrated in Figure 4. Hourly composite samples will be collected automatically by the sampler by having each 1 liter bottle filled with 250ml of sample every 15 minutes. Programming limitations within the sampler however will require manual composites to be developed for TSS & BOD for the 30 minute composites. The 30 minute composite samples will be prepared by sampling personnel when they return to the office to process samples for pickup by the laboratory. The 30 minute composite will be developed by first shaking the sampler bottles and directly pouring the two, 1 liter, 15 minute discrete samples collected by the automatic sampler into a clean 2-liter bottle provided by the laboratory. The 2-liter bottle will then be put into cold storage with the other sample bottles until transported to the laboratory. These will be composited by hand when the samples are processed.

The proposed sample collection matrix was established to address several concerns of the NJDEP while minimizing the cost to complete this work. Fecal coliform sampling must be done as a grab and using a special container, while pH and temperature must be obtained in the field. We therefore propose that fecal coliform, pH, and temperature sampling be conducted as two groups. At one monitoring site (which will change with each storm event), fecal coliform, pH, and temperature samples will be conducted every fifteen minutes during the first two hours, every thirty minutes for the second two hours, and then once per hour for up to three additional hours should the overflow event continue. This will provide data on the drainage areas response to these parameters over time and will allow for the analysis of a "first flush" effect. The second group of sites will include all other stations being monitored during that particular storm event. These sites will be monitored on a rotating basis during the overflow event. It is anticipated that frequency of monitoring for these sites will be approximately one to two hours.

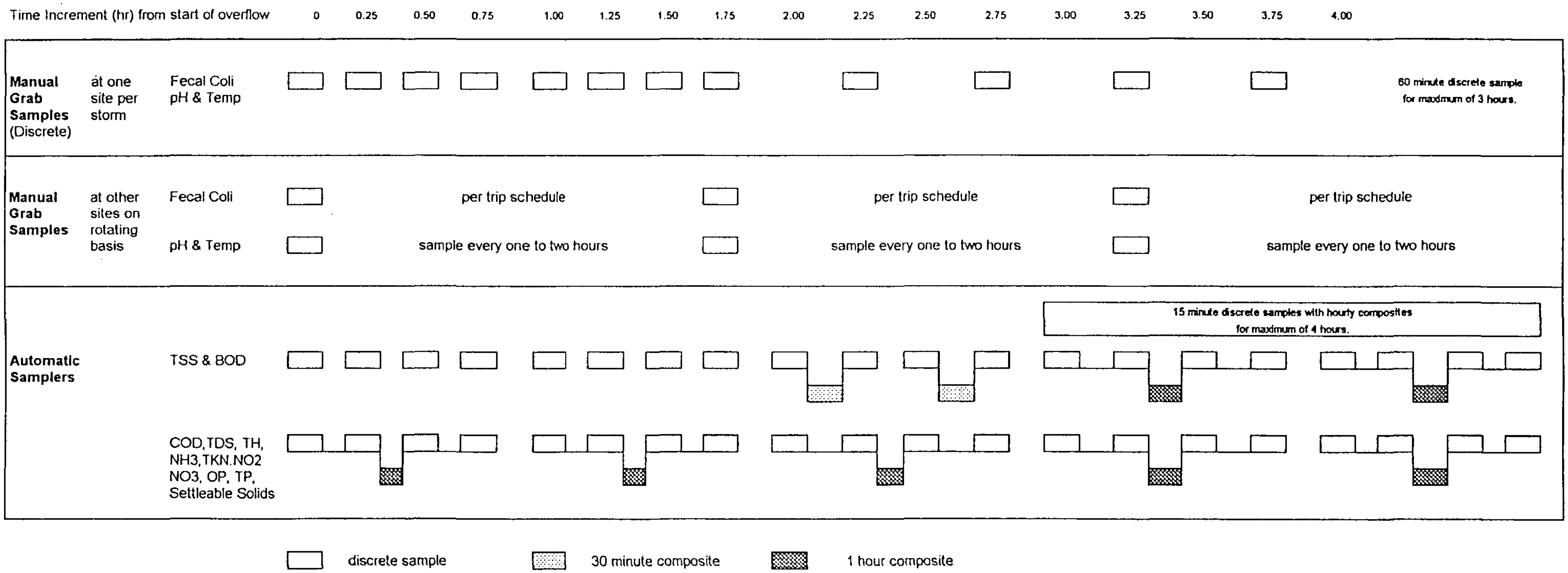
Automatic samplers will be used to collect wastewater samples for all other parameters. In order to assess the existing of a "first flush" pollutant load, TSS and BOD samples will be initially collected at a greater frequency. Thus TSS and BOD samples will be collected by the automatic sampler at fifteen minute intervals and analyzed as discrete samples for the first two hours, collected by the automatic sampler as discrete samples at fifteen minute intervals and manually composited and analyzed as thirty minute composites for the next hour, and automatically collected and composited at fifteen minute intervals and analyzed as hourly composites for up to an additional four hours. All other water quality parameters will be automatically collected and composited at fifteen minute intervals as indicated in Figure 4.

Sample collection will be completed using the following procedures: The automatic samplers will be set to collect single discrete 15 minute samples for TSS & BOD and multiple (4) 250 ml liter samples every 15 minutes for other parameters. The sampling will begin from the onset of the overflow to a maximum of seven (7) hours after the overflow begins. Should the sampling and overflow continue beyond three (3) hours, a new bottle case will be installed and the sampler set to collect multiple 250 ml samples every fifteen minutes to provide adequate sample volume for the parameters indicated. The total sample volume required for the proposed list of water quality parameters is one to two liters for the TSS and BOD samples and four liters for the other parameters.

<u>Water Quality Parameters</u>:

The samples collected from each site will be analyzed as individual discrete or composite samples for analysis as indicated. One hour composite samples will be developed automatically by the sampler by collecting 250 ml samples in multiple bottles every 15 minutes. Thirty minute composite samples will be developed manually from 15 minute discrete samples once monitoring has ended. Parameters analyzed will include those listed in Table III of the General CSO Permit. Samples collected by the automatic sampling equipment will be analyzed for Chemical Oxygen Demand; 5 day Biochemical Oxygen Demand; Suspended Solids; Settleable Solids; Total Dissolved Solids; Nitrogen Series including ammonia, nitrites + nitrates, and

Figure 4
Wet Weather Sampling and Analytical Sequence



Note: Maximum Sampling Period Is Seven Hours

Total Kjeldahl Nitrogen; Phosphorus Series including Orthophosphate and Total Phosphorus; and Hardness.

Sample Handling:

Grab samples for pH and temperature will be collected using a clean bucket. The bucket will be cleaned with a laboratory grade cleaning solution prior to going into the field. The bucket will be rinsed with deionized water prior to and following collection of each sample. Grab samples for fecal coliforms will be collected directly into sterilized containers and preserved as required in the NJDEP Field Sampling Procedures Manual, May 1992 Edition (See page 37 of manual). Field blanks for pH and fecal coliforms will not be conducted.

All sampling equipment used in the field will be cleaned and decontaminated in the office using laboratory grade glassware detergent, generous tap water wash, and a distilled and deionized water rinse. Composite samples collected will be collected using an ISCO Model 6700 automatic sampler. Sampler hoses will be changed and discarded after each sampling event. A field blank of deionized water will be collected through the sampler during each setup and analyzed for all laboratory parameters (COD, $CBOD_5$, TSS, Settleable Solids, Total Dissolved Solids, Nitrogen Series, Phosphorus Series, and Total Hardness).

All water quality parameters, with the exception of fecal coliforms which will be analyzed locally, and temperature and pH which will be field monitored with instrumentation, will be analyzed by Thermo Analytical's (TMA) Lancaster, Pennsylvania facility which is a N.J. Certified Laboratory (Certification #77011). Fecal coliform analysis will be conducted primarily by W.A.T.E.R. Works Laboratory, Inc., of East Orange (Certification #07673). Garden State Labs (Certification No. 20044) and Aqua Associates (Certification No. 07066) will be used as backup labs for fecal coliform analyses should the number of samples and/or holding times be beyond the capabilities of Water Works Laboratory, Inc.

Field instruments for pH, and temperature will be calibrated and used according to the procedures outlined in N.J.A.C. 7:18, "Regulations Governing Laboratory Certification and Standards of Performance." Temperature will be monitored directly in the sample using a Yellow Springs D.O. meter and probe, while pH will be monitored using a pH meter and probe field calibrated using appropriate buffers. The pH meter calibrations will be checked as required by the above referenced publication. Water quality field measurements will be conducted under Killam Associates NJDEP Certification #07059.

Flow Measurement:

In addition to the water quality sampling, the volumetric flow rate and volume will be determined at each of the CSO control facilities during a monitored overflow event. The flow monitoring equipment will be installed in either the overflow discharge pipe downstream of the combined sewer overflow chamber or within the overflow chamber (sandcatcher compartment) of the control facility. Monitoring within the overflow chamber will be for depth of flow and velocity within the chamber. The depth measurements made in the chamber will also be used to determine the overflow rate by using the height of flow over the weir adjusted for submergence by tidal or high water influences, and weir formulas established in previous studies.

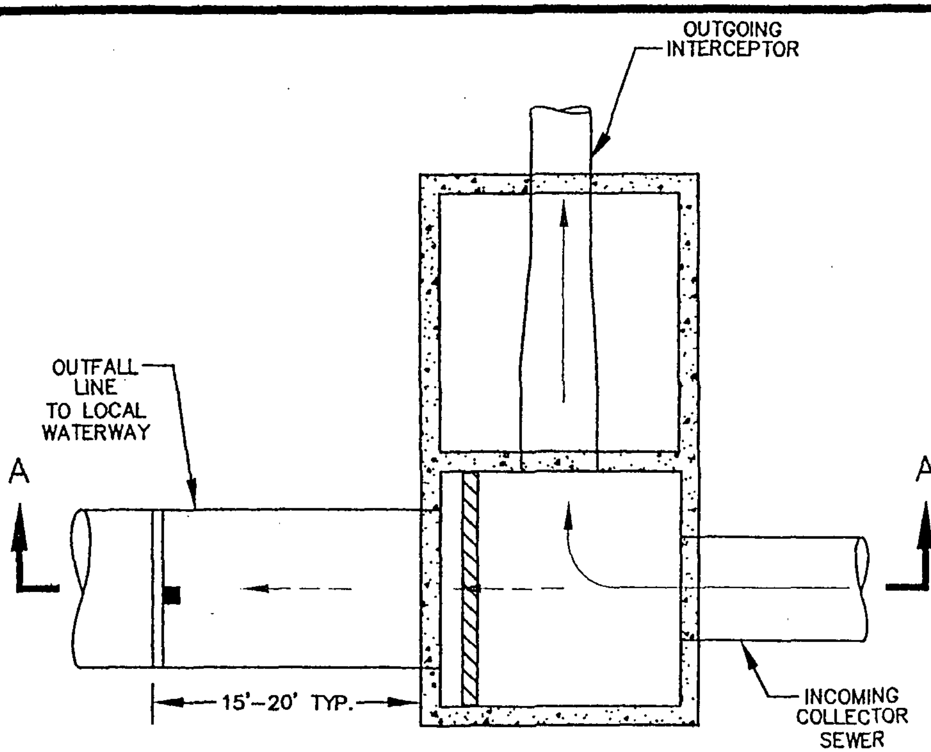
Flow measurements shall be obtained using a Sigma Model 950AV which incorporates a bubbler for flow depths and an ultrasonic Doppler transducer to determine velocity. Where monitoring is conducted in the sand catcher, the depth sensor will be installed along the side of the sandcatcher chamber a minimum distance from the weir of twice the maximum head anticipated. Where monitoring is conducted in the outfall pipe, flow depth and velocity will be determined by the Doppler meter. The following specifies the monitoring location which will be used to monitor overflows at each monitoring location while Figures 5 through 8 illustrate the location of flow or depth sensors:

PVSC Reg. #	Name	Monitoring Location
33	Johnston Avenue	Overflow Chamber
34	Ivy Street	Outfall Pipe
45	Worthington Ave.	Overflow Chamber
01	Curtis Place	Outfall Pipe
06	Montgomery	Overflow Chamber
	Loop Road	Outfall Pipe
16	Northwest	Outfall Pipe
25	Tenth and Thirty-Third	Outfall Pipe
27	Market Street	Outfall Pipe
	19^{th} Avenue	Outfall Pipe
38	Central Avenue	Collector Sewer

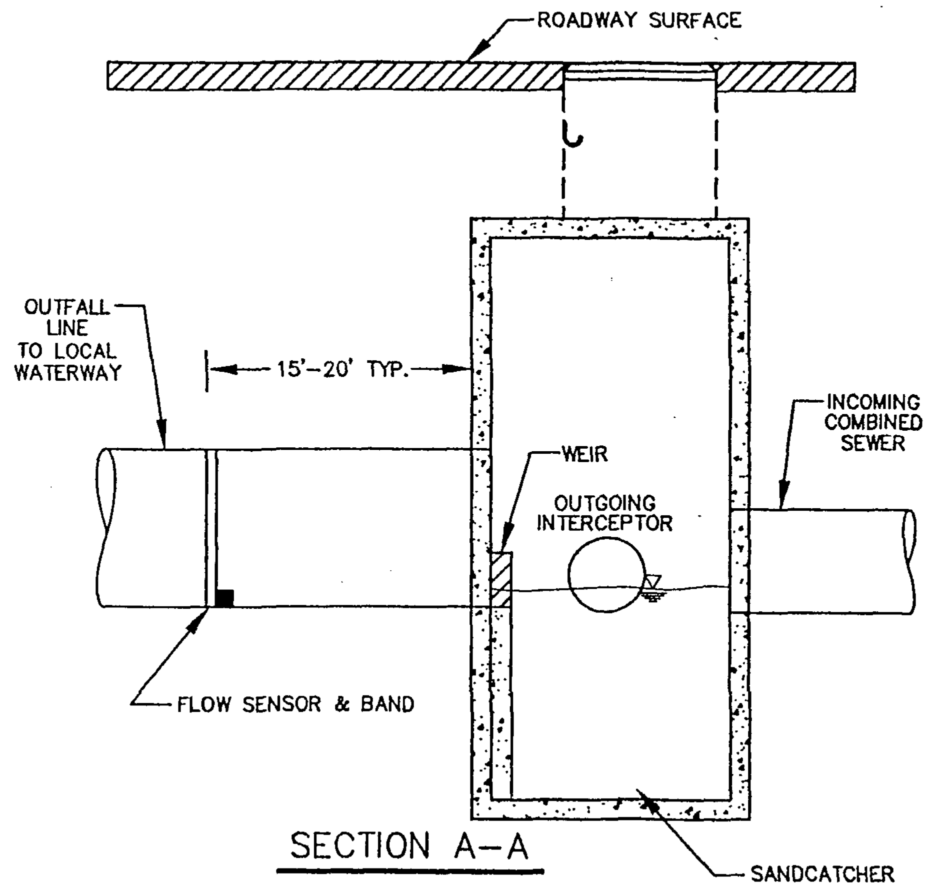
In addition to the monitoring of flows at the overflow chamber or discharge pipe, additional area-velocity meters will be installed in at least one upstream manhole to monitor wet weather flows upstream of the combined sewer overflow facility. The locations utilized for the wet weather system monitoring will be the same as those proposed and used in the baseline monitoring and illustrated in Plates 1 through 10.

II. Rationale

Sampling and flow monitoring will be conducted so that combined sewer overflow quantity and quality can be characterized for each of the combined sewer drainage areas, including determination of relationships between rainfall, runoff/overflow volume and pollutant loads. The data obtained will be used in the calibration and verification of the (SWMM) Storm Water Management Model Level 4 for all the combined sewer drainage basins tributary to the PVSC



PLAN



SECTION A-A

PROPOSED
METER INSTALLATION FOR:
IVY STREET
CURTIS PLACE
MARKET STREET

LEGEND

WET WEATHER FLOW
DRY WEATHER FLOW

Passaic Valley Sewerage Commissioners
Combined Sewer Overflow
Planning Study

TYPICAL CSO CONTROL FACILITY WITHOUT TIDE GATES

Killam

FIGURE 5

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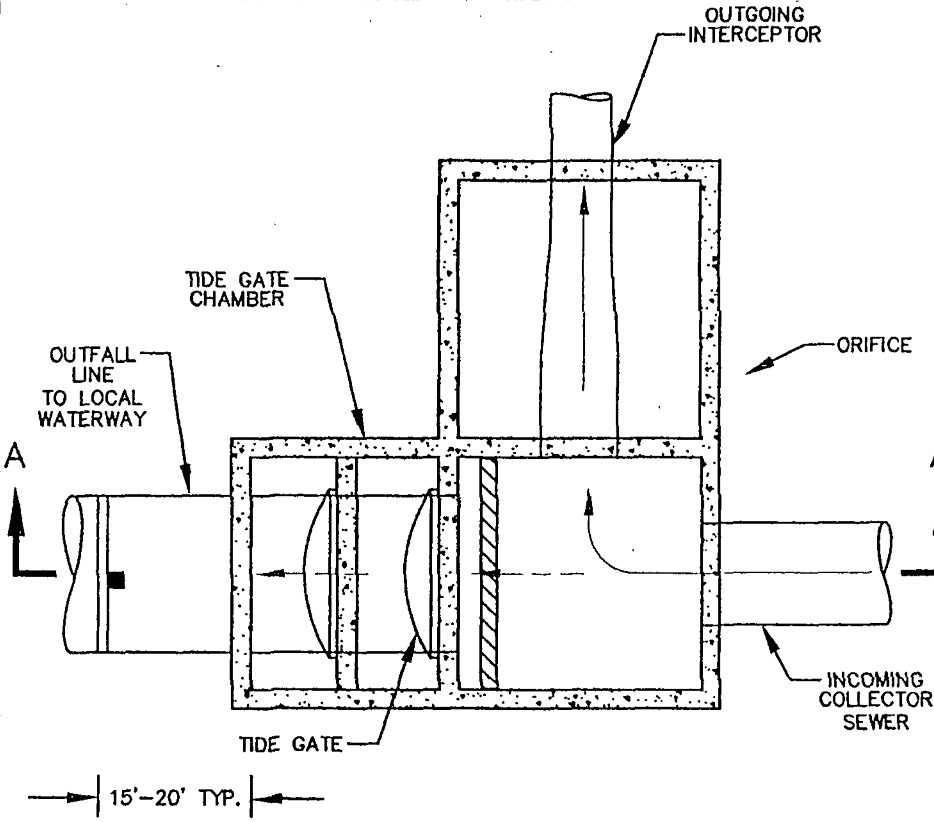
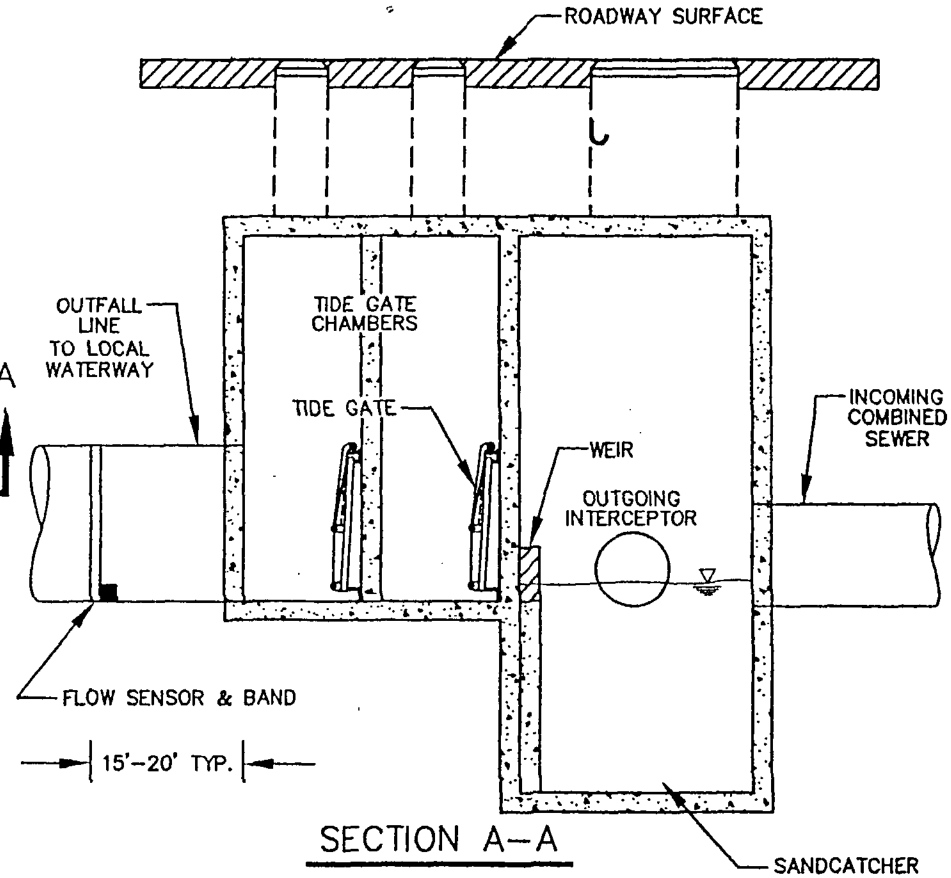


PLAN



SECTION A–A

PROPOSED
METER INSTALLATION FOR:
NORTHWEST STREET
10TH AVE. & 33RD STREET

LEGEND

- - → WET WEATHER FLOW
—— → DRY WEATHER FLOW

Passaic Valley Sewerage Commissioners
Combined Sewer Overflow
Planning Study

TYPICAL CSO CONTROL FACILITY WITH TIDE GATES

Killam | FIGURE 6

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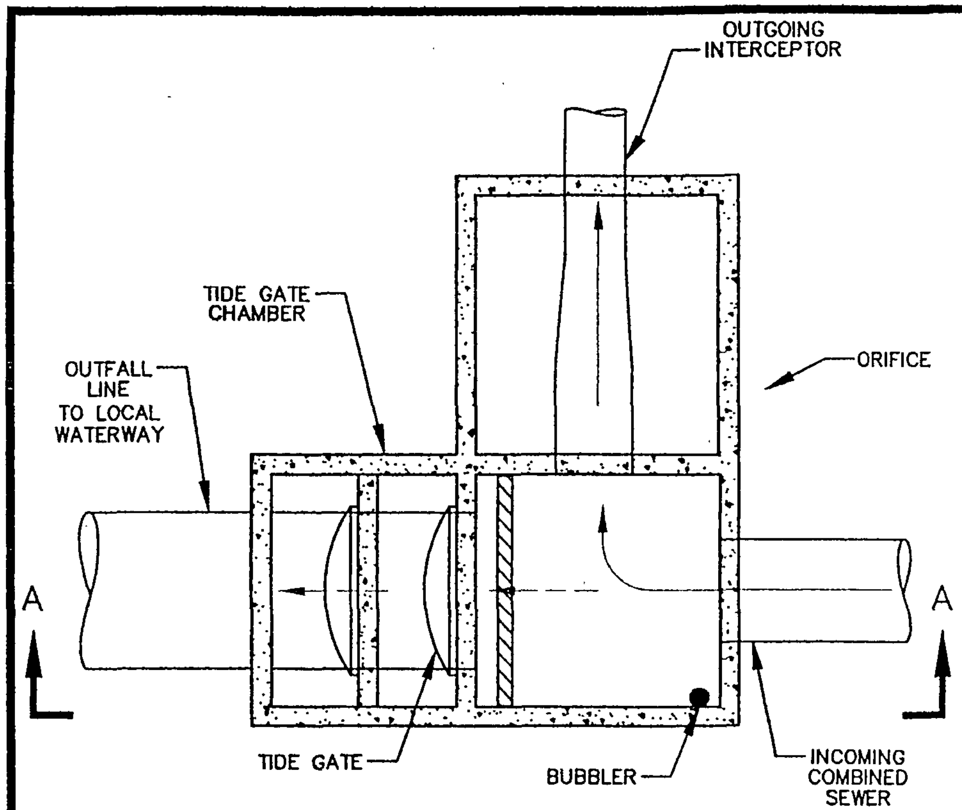
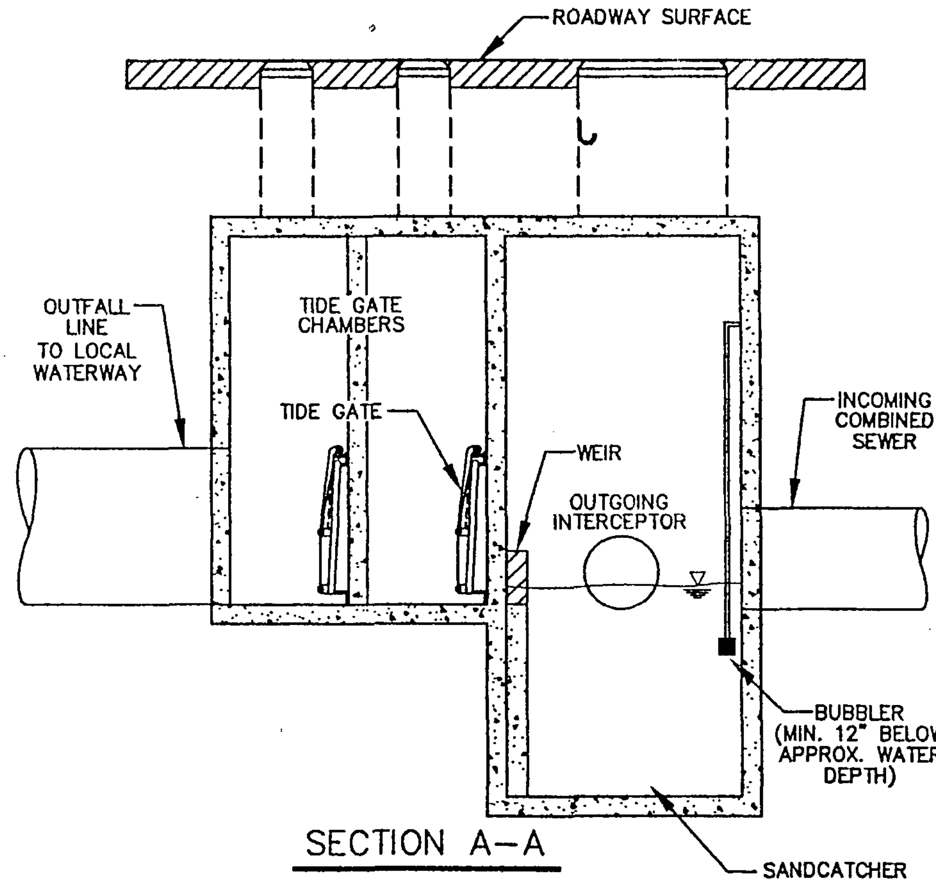


PLAN



SECTION A–A

PROPOSED
METER INSTALLATION FOR:
JOHNSON AVENUE
WORTHINGTON AVENUE
MONTGOMERY STREET
CENTRAL AVENUE

LEGEND

- - - → WET WEATHER FLOW
——→ DRY WEATHER FLOW

Passaic Valley Sewerage Commissioners
Combined Sewer Overflow
Planning Study

TYPICAL CSO CONTROL FACILITY WITH TIDE GATES

Killam FIGURE 7

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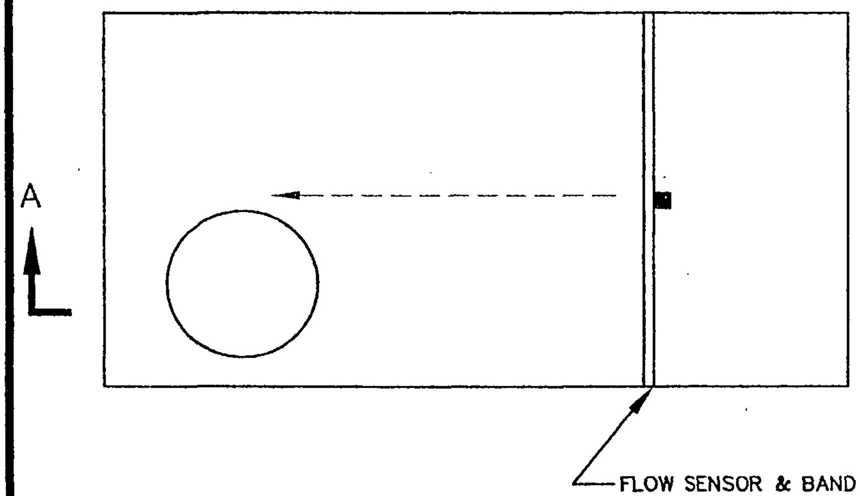
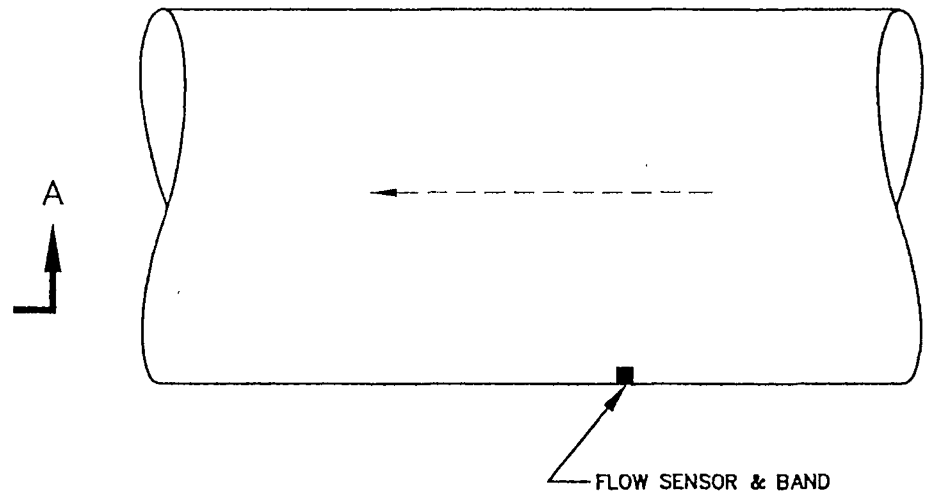


PLAN



SECTION A–A

PROPOSED
METER INSTALLATION FOR:
LOOP ROAD
19TH AVENUE

LEGEND

- - - → WET WEATHER FLOW
——→ DRY WEATHER FLOW

Passaic Valley Sewerage Commissioners
Combined Sewer Overflow Planning Study

TYPICAL CSO CONTROL FACILITY

Killam

FIGURE 8

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control facilities and interceptor. Monitoring will include rainfall intensities, volumes, and duration as well as receiving water stage to determine any backwater effects upon tide gates and discharge volumes. All parameters will be collected in real time so that the interrelationship between rainfall, receiving water levels and CSO discharges can be established.

The proposed frequency represents an alternative sampling protocol relative to the uniform 15 minute period specified in the General Permit. The proposed protocol is based in part on practical aspects of collecting samples from a number of sites during the same storm event, and avoiding the cost and logistic aspects associated with the collection of extraneous data that is unnecessary for meeting project objectives. The data that will be provided by the protocol that is described in this work plan will provide an adequate characterization of the general quality and variability of CSO discharges in the project area.

Suspended solids (TSS) and 5-day biochemical oxygen demand (BOD5) will be sampled at all sites at a high frequency, during every storm. Sequential discrete sample measurements for these two parameters will be obtained every 15 minutes during the first two hours of overflow, every 30 minutes during the 3rd hour of overflow, and hourly thereafter for a maximum of seven (7) hours. These parameters are the most appropriate ones to use for characterizing within-storm variations and assessing first-flush effects.

Fecal coliform measurements will also be made on a similar sampling frequency as described above for TSS and BOD5. The difference will be that coliform sampling will be conducted at only one of the monitoring sites during a particular storm. This will provide multiple samples for characterizing the bacterial quality of an overflow event (useful because of the inherent variability of this type data). Each of the monitoring sites will be sampled in this manner on a rotating basis. For the other CSO sites in the group being sampled, discrete grab samples for fecal coliform will be collected several times during the event (every 1 to 2 hours) by a field crew rotating through all of the sites. This procedure is proposed because it would be prohibitively expensive to station separate field crews to collect multiple grabs throughout the overflow period at all of the monitoring sites, and it is fully expected that the proposed procedure will provide adequate data for subsequent project use.

The parameters requiring field measurement (pH and temperature) will be collected on the same rotating schedule as the fecal coliform sampling. These parameters are not critical ones, are not expected to vary significantly during an overflow event, and are not a factor in pollutant load determinations that will be made. Thus the proposed schedule will be more than adequate for characterizing these parameters.

For the remaining conventional pollutants (COD, TDS, TH, settleable solids, N-series and P-series), the important aspect for modeling as well as subsequent load impact assessments is the total pollutant load associated with the overflow event. Accordingly, the sampling protocol proposed for these parameters is designed to secure separate 1-hour composites for each hour of the overflow event that is monitored. This will provide a sequence of measurements across the duration of the event that can be used with the flow data to compute an accurate value for the total event loading. The additional information provided on variation over the storm (in 1-hour average values) will be useful incidental information that is provided by this protocol.

D. Monitoring Parameters and their Frequency of Collection

Measurement:	Rainfall:	Continuous - Recorded at *10* minute intervals.
	Tide/Stage:	Continuous - Recorded at 15 minute intervals.
	CSO Volume:	Continuous during overflow event and recorded every 5 minutes.
	DWF Flows	Continuous over a 1 month period.
Sample Type:	CSO	Manual grab samples and both discrete and composite samples using automatic sampler equipment - obtained at frequency described earlier, during the combined sewer overflow discharge for a maximum period of 7 hours.
	DWF	24-hour flow composite of dry weather flow obtained with automatic sampling equipment. Grab samples at random times during the monitoring period for fecal coliform, pH and temperature.

Sample Matrix - CSO: Aqueous

Parameters Analyzed:

CSO and DWF:	Temperature, pH, Fecal Coliforms, TSS, BOD5, COD, Settleable Solids, TDS, N-Series, P-Series, Total Hardness.
Sample Type and Frequency:	(See Figure 4)
Manual Grabs:	Temperature, pH, and Fecal Coliforms
Sequential Discrete:	Automatic Sampler - variable frequency 15 minute discrete to 1 hour composite samples for TSS and BOD.
Composite:	Automatic Sampler - 1 hour composites for COD, Settleable Solids, TDS, N-Series, P-Series, Total Hardness

E. Parameter Table

With the exception of fecal coliforms and field measurements, TMA's Lancaster Laboratory, a NJDEP Certified Laboratory, will perform laboratory analysis in accordance with NJDEP Table 1B -List of Approved Inorganic Test procedures and NJDEP Table II - Required Containers, Preservation Techniques, and Holding Times. Tables IB and II have been certified by the Project Officer. Fecal coliform analyses will be conducted primarily by Water Works Labs (NJDEP Certification No. 07673) with backup analyses conducted, if necessary because of sample volume, by one of the following:

Garden State Labs	Certification No. 20044	Hillside
Aqua Associates	Certification No. 07066	Fairfield

Any deviations from the test procedures and/or preservation methods and/or holding time will be noted in the project report. Changes to the approved test procedures and/or preservation methods will not be made without the prior approval from NJDEP and the submission of a new title page for signatures of approval.

8. Project Fiscal Information: (Not Applicable)

9. Proposed Schedule of Tasks and Products:

The proposed monitoring study will be completed over a two year period. Three (3) to four (4) storm events will be monitored over the first twelve (12) to eighteen (18) months at each of the eleven (11) wet weather monitoring locations. The SWMM level 4 calibration/validation effort will commence with receipt of approval from NJDEP of the Modeling Quality Assurance / Work Plan and the request to proceed, which will be submitted as soon as possible following the completion of the first group of sampling sites and will conclude approximately two years from the start of the program.

The sample collection program will only be conducted when significant rainfall events are predicted. A significant rainfall event is herein designated as a rainfall event for which a predicted rainfall volume of 0.5 to 1.0 inches is predicted within a twenty-four (24) hour period. The sampling program will be initiated by Killam Associates after rainfall and receiving water gagging stations are established and will continue on a routine basis until all episodes are completed. It is anticipated that sample collection will be completed no later than June 1, 1999. The final project report, which will contain all data and analyses relevant to the study, will be submitted to NJDEP on or about December 1, 1999.

10. Project Organizations and Responsibility:

Shown below is a list of key project personnel and their responsibilities.

Sampling Operations:	Roger Standfast (KA) Marc Ferko (NJDEP)
Sampling Quality Control:	Roger Standfast (KA)
Laboratory Analysis:	Wilson Hershey (TMA) Bonnie Gingrass (WW)
Laboratory Quality Control:	M. Louise Hess (TMA) Stephen Kroemer (WW)
Data Processing:	John S. Rolak, Jr., P.E. (KA)
Data Processing Quality Control:	Robert A. Albright, Jr., P.E. (KA)
Data Quality Review:	William Leo (HydroQual, Inc.) Staff Member (NJDEP)

Performance Auditing:	Erik Frederiksen (TMA) Stephen Kroemer (WW) Marc Ferko (NJDEP)
Systems Auditing:	Nelson Risser (TMA) Stephen Kroemer (WW) Marc Ferko (NJDEP)
Overall Quality Assurance:	Robert A. Albright, Jr., P.E. (KA)
Overall Project Coordination: (Data Collection)	Robert A. Albright, Jr., P.E. (KA)
Overall Project Coordination: (Data Analysis)	John S. Rolak, Jr., P.E. (KA)

11. **Data Quality Objectives and Assessments:**

TMA and WW will follow the "Regulations Governing Laboratory Certification and Standards of Performance," N.J.A.C. 7:18-1.1 et. seq. and 40 CFR Part 136 for all quality assurance/quality control (QA/QC) practices, including detection limits, quantification limits, precision and accuracy. The proposed analytical parameters and sample characteristics are listed in the following sections of this plan:

Parameters:	As per Section 7E of this Work Plan.
Sample Matrix:	As per Section 7D of this Work Plan.
Detection Limits:	As per attached Table
Quantification Limits:	As per attached Table
Estimated Accuracy:	As per attached Table
Estimated Precision:	As per attached Table

Detection limits for samples analyzed will differ from the values provided if parameter levels are above the PQL and the sample is diluted by the laboratory.

A. **Data Representativeness:**

Sampling will conform with Section 7C.

B. **Data Comparability:**

Sampling will conform with Section 7C. Analytical data comparability will be achieved by having TMA utilize the analytical methodologies, preservation and holding times as prescribed in Tables IB and II herein enclosed. Each particular methodology will be analyzed using the referenced methodology, and changes in methodology will not take place from sample to sample. The sample holds true for preservation, holding times and QA/QC practices.

C. **Data Completeness:**

Data will be considered complete and usable for decision making when all results are submitted to NJDEP in accordance with the USEPA approved methodology and QA/QC practices listed in this project plan.

12. **Sampling Procedures:**

Reference: NJDEP Field Sampling Procedures Manual, May 1992 Edition, Chapter I, Sections B(1-4)

All sampling procedures shall be in conformance with the above-referenced procedure. The sampling sites approved by the Department prior to the commencement of the sampling program shall be considered to be representative sites. Flow measurements will be determined within CSO Control Facilities by use of SIGMA 950AV Area Velocity Flow Meter which will be installed to measure the volume and flow of combined wastewater overflowing the weir in the sandcatcher. Instrumentation used for the collection of field data shall be properly calibrated in conformance with the manufacturers' instructions, the May 1992 Edition of DWR Field Sampling Procedure Manual, and N.J.A.C. 7:18-1.1 et. seq.

13. **Chain of Custody Procedures:**

Chain of custody (COC) procedures will be followed for all samples collected for this project and the forms will provide the pertinent information shown in the attached sample. A sample is in someone's "custody" if:

a. It is in one's actual physical possession;

b. It is in one's view, after being in one's physical possession;

c. It is in one's physical possession and then locked up so that no one can tamper with it;

d. It is kept in a secured area, restricted to authorized personnel only.

A sample chain of custody form is attached.

14. Calibration Procedures and Preventative Maintenance

Calibration of field equipment will be done in accordance with the manufacturers' instructions. Samplers will have a preventive maintenance procedure which will be followed. It will also be utilized in the event that the equipment fails to operate properly under which conditions Killam Associates may vary the procedure as necessary under these circumstances. These procedures will be in accordance with the Field Sampling Procedures Manual.

Calibration of laboratory equipment will be done in accordance with "Regulations Governing Laboratory Certification and Standards of Performance," N.J.A.C. 7:18-1.1 et. seq., 40 CFR Part 136 and Killam Associates QA policies and procedures.

15. Documentation, Data Reduction and Reporting:

A. Documentation

All analytical results will be reported to the NJDEP with all supporting QA/QC information and data. All data will be maintained on file at the laboratory for a minimum of five (5) years, as per N.J.A.C. 7:18-1.1 et. seq.

B. Data Reduction and Reporting

All water quality data will be entered into a SAS database for data reduction. Data sets will be analyzed using appropriate data groupings. The results of all data reduction and analyses will be included in the final project report.

16. Data Validation

Upon receipt of data, the Data Processing Quality Assurance Officer will review all data for consistency and will verify through the analytical laboratory or flow monitoring personnel all data which appears to be inconsistent. In addition, any summary tables prepared for this project will be verified for accuracy by the Data Processing Quality Assurance Officer. Overall data validation will be reviewed by the project quality assurance officer and will be provided with the final report.

17. Performance and Systems Audits:

A. Performance Audits

All NJDEP certified laboratories participate bi-annually in the USEPA's Performance Evaluation (PE) studies for each category of certification. Laboratories are required to pass each of these PE studies in order to maintain certification. The NJDEP Office of Quality Assurance conducts a performance audit of each laboratory that is certified.

B. Systems Audits

The NJDEP Office of Quality Assurance periodically conducts on-site Technical Systems Audits (TSAs) of each certified laboratory. The findings of these audits, together with the USEPA PE results, are used to update each laboratory's certification status. The NJDEP Office of Quality Assurance, as well as other NJDEP offices (such as DWR Enforcement), periodically conducts field audits of project sampling operations.

C. Notification of NJDEP

The Office of Quality Assurance will be notified when sampling will be performed so that an audit may be performed.

18. Corrective Action:

As in all NJDEP certified laboratories, TMA's Lancaster Laboratory and Water Works Laboratory is required to maintain a Standard Operating Procedures (SOP) manual which outlines specific action to pursue should corrective action be necessary. If acceptable results cannot be obtained due to calibration standards, PE samples, blanks, spikes or duplicates falling out of range, the affected samples will be re-analyzed. Killam Associates will notify the Department in writing anytime a deviation from the approved plan is performed.

19. **Reports:**

Progress reports, identifying the status of monitoring and modeling tasks, will be submitted on a semi-annual basis, with issue dates on the fifteenth day of June and December, over the duration of the project. These reports will track progress toward completion in relation to the approved schedule, and identify any problems encountered together with proposed or implemented corrective actions.

As indicated earlier, the monitoring program will be conducted in two stages, in order to accommodate the distance between the distinct northern and southern groupings of CSO monitoring sites. An interim CSO Characterization Report summarizing and evaluating the first stage monitoring data will be issued two months following the completion of the first stage effort, expected to be about fifteen (15) months following official initiation of the program. At that time, a work plan describing pertinent details of the proposed SWMM model will be submitted to NJDEP, with a formal request for authorization to proceed with calibration/validation of the SWMM model which is to be the product of the Combined Sewer System Modeling Study.

The model description, calibration and analysis results will be presented in a CSO Modeling Report, which will be prepared as a Technical Appendix. All monitoring data will be listed and summarized in an additional Data Appendix. Both of these reports will be issued six (6) months following completion of the second, and final, stage of the overall CSO monitoring program.

It is anticipated that a final report will be submitted to NJDEP for review and approval on or before December 1, 1999. This report will contain, at a minimum, the pertinent results of monitoring data. Analytical results will be submitted to the NJDEP along with the data validation findings.

December 4, 1997

Site: Lancaster Laboratories

Parameter	Method	MDL	IDL	PQL	95% C. I.	PRECISION	QC PROTOCOL
Ammonia-N	EPA 350.2	0.16 mg/l	NA	1.0 mg/l	93.5 - 99.1	+/- 15.41 %	LCS, LCSD, Dup. - 10%, MS, MSD - 5% Frequency
Kjeldahl Nitrogen	EPA 351.2	0.15 mg/l	NA	0.2 mg/l	69.5 - 126.5	+/- 20 %	LCS, LCSD, Dup., MS,MSD - 5% Frequency
Nitrate-N	EPA 353.2	0.04 mg/l	NA	0.05 mg/l	93.6 - 111.5	+/- 20 %	LCS, LCSD, Dup. - 10%, MS - 10% Frequency
Nitrite-N	EPA 353.2	0.015 mg/l	NA	0.02 mg/l	91.1 - 106.0	+/- 20 %	LCS, LCSD, Dup. - 10%, MS - 10% Frequency
Total Phosphorus	EPA 365.1	0.04 mg/l	NA	0.05 mg/l	90.0 - 111.5	+/- 20 %	LCS, LCSD, Dup, MS,MSD - 5% Frequency
Orthophosphorus	EPA 365.3	0.003 mg/l	NA	0.01 mg/l	94.5 - 103.5	+/- 14.4 %	LCS, LCSD, Dup., MS,- 10% Frequency
COD	EPA 410.4	5.44 mg/l	NA	50. mg/l	96.8 - 101.9	+/- 4.35 %	LCS, LCSD, Dup., MS,- 10% Frequency
BOD5	EPA 405.1	.56 mg/l	NA	2.0 mg/l	96.8 - 119.7	+/- 7.75 %	LCS, LCSD, Dup., MS,- 10% Frequency
TS	EPA 160.3	12.5 mg/l	NA	40. mg/l	87.5 - 110.9	+/- 7.13 %	LCS, LCSD, Dup., MS,- 10% Frequency
TSS	EPA 160.2	3.36 mg/l	NA	9.0 mg/l	83.3 - 103.3	+/- 26.13 %	LCS, LCSD, Dup., MS,- 10% Frequency
TDS	EPA 160.1	5.36 mg/l	NA	30. mg/l	80.6 - 112.1	+/- 5.33 %	LCS, LCSD, Dup., MS,- 10% Frequency
Total Hardness	EPA 130.2	1.0 mg/l	NA	3.0 mg/l	94.3 - 101.6	+/- 6.78 %	LCS, LCSD, Dup., MS,- 10% Frequency
Settleable Solids	EPA 160.5	NA	NA	0.2 mg/l	NA	+/- 20 %	Dup. - 5% Frequency

TABLE IA.—LIST OF APPROVED BIOLOGICAL TEST PROCEDURES

Parameter, units and method	Method [1]	EPA [2]	Reference (method No. or page)		
			Standard methods 18th ed.	ASTM	USGS [3]
Bacteria:					
1. Coliform (fecal), number per 100 ml.	MPN, 5 tube, 3 dilution; or, membrane filter (MF) [4], single step.	p. 132 p. 124	9221C 9222D		
2. Coliform (fecal) in presence of chlorine, number per 100 ml.	MPN, 5 tube, 3 dilution; or, MF [4], single step [5].	p. 132 p. 124	9221C 9222D	----------	B-0050-85.
3. Coliform (total, number per 100 ml.).	MPN, 5 tube, 3 dilution; or, MF [4], single step or two step.	p. 114 p. 108	9221B 9222B	----------	B-0025-85.
4. Coliform (total), in presence of chlorine, number per 100 ml.	MPN, 5 tube, dilution; or MF [4] with enrichment.	p. 114 p. 111	9221B 9222B-8.5C		
5. Fecal streptococci, number per 100 ml.	MPN, 5 tube, 3 dilution; MF [4]; or, plate count.	p. 139 p. 136 p. 143	9230B 9230C	----------	B-0055-85.

Table IA notes:

[1] The method used must be specified when results are reported.

[2] Bordner, R.H., and J.A. Winter, eds. 1978. "Microbiological Methods for Monitoring the Environment, Water and Waste." Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency. EPA-600/8-78-017.

[3] Britton, L.J., and P.E. Greeson, P.E., eds., 1989. "Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples." Techniques of Water Resources Investigations of the U.S. Geological Survey. Techniques of Water Resources Investigations, Book 5, Chapter A4, Laboratory Analysis, U.S. Geographic Survey, U.S. Department of Interior, Reston, Virginia.

[4] A 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth.

[5] Because the MF technique usually yields low and variable recovery from chlorinated wastewaters, the Most Probable Number method will be required to resolve any controversies.

I, the Project Officer, agree and assure that the above circled parameters and methods will be used for this project. Any changes/deviations will first be submitted to Joel Simpkins of NJDEP with a new title page for signatures of approval.

Project Officer Signature | 7/24/97 Date

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TABLE 1B.—LIST OF APPROVED INORGANIC TEST PROCEDURES

Parameter, units and methods	Reference (Method No. or Page)		ASTM	USGS[2]	Other
	EPA[1,35]	Std. method 18th ed.			
1. Acidity, as $CaCO_3$, mg/L:					
Electrometric end point or phenolphthalein end point	305.1	2310–B(4a)	D1067–88		
2. Alkalinity, as $CaCO_3$, mg/L:					
Electrometric or colorimetric titration to pH 4.5 manual or	310.1	2320–B	D1067–88	I–1030–85	973.43.[3]
Automated	310.2			I–2030–85	
3. Aluminum—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	202.1	3111D		I–3051–85	
AA furnace	202.2	3113B			
Inductively coupled plasma (ICP)[36]	[6]200.7	3120B			
Direct current plasma (DCP)[36], or			D4190–88		Note 34.
Colorimetric (Eriochrome cyanine R)		3500–Al D			
4. Ammonia (as N), mg/L:					
Manual distillation (at pH 9.5)[6], followed by	350.2	4500–NH_3 B			973.49.[3]
Nesslerization	350.2	4500–NH_3 C	D1426–79(A)	I–3520–85	973.48.[3]
Titration	350.2	4500–NH_3 E			
Electrode	350.3	4500–NH_3 G	D1426–79(D)		
Automated phenate or	350.1	4500–NH_3 H	D1426–79(C)	I–4523.85	
Automated electrode					Note 7.
5. Antimony—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	204.1	3111 B			
AA furnace, or	204.2	3113 B			
ICP[36]	[6]200.7	3120 B			
6. Arsenic-Total[4], mg/L; digestion[4] followed by	206.5				
AA gaseous hydride	206.3	3114 B 4.d	D2972–84(B)	I–3062–85	
AA furnace	206.2	3113 B			
ICP[36], or	[6]200.7	3120 B			
Colorimetric (SDDC)	206.4	3500–As C	D2972–84(A)	I–3060–85	
7. Barium—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	208.1	3111 D		I–3084–85	
AA furnace	208.2	3113 B			
ICP[36], or	[6]200.7	3120 B			
DCP[36]					Note 34.
8. Beryllium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	210.1	3111 D	D3645–84–88(A)	I–3095–85	
AA furnace	210.2	3113 B			
ICP	200.7[6]	3120 B			
DCP, or			D4190–88		Note 34.
Colorimetric (aluminon)		3500–Be D			
9. Biochemical oxygen demand (BOD_5), mg/L:					
Dissolved Oxygen Depletion	405.1	5210		I–1578–78[8]	973.44[3] p. 17.[9]
10. Boron—Total, mg/L:					
Colorimetric (curcumin)	212.3	4500–B B		I–3112–85	
ICP, or	200.7[6]	3120 B			
DCP			D4190–88		Note 34.

I, the Project Officer, agree and assure that the above circled parameters and methods will be used for this project. Any changes/deviations will first be submitted to Joel Simpkins of NJDEP with a new title page for signatures of approval.

Project Officer Signature

7/24/97

Date

946210062

TABLE 1B.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units and methods	Reference (Method No. or Page) EPA[1,35]	Std. method 18th ed.	ASTM	USGS[2]	Other
11. Bromide, mg/L:					
Titrimetric	320.1		D1246–82(C) (1988)	I–1125–85	p. S44.[10]
12. Cadmium—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	213.1	3111 B or C	D3557–90 (A or B)	I–3135–85 or I–3136–85.	[3]974.27 [3]p.37.
AA furnace	213.2	3113 B			
ICP[36]	[5]200.7	3120 B		I–1472–85	
DCP[36]			D4190–88		Note 34.
Voltametry[11], or	3557–90C.				
Colorimetric (Dithizone)		3500–Cd D			
13. Calcium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	215.1	3111 B	D511–88(B)	I–3152–85	
ICP	200.7[5]	3120 B			
DCP, or					Note 34.
Titrimetric (EDTA)	215.2	3500–Ca D	D511–88(A)		
14. Carbonaceous biochemical oxygen demand (CBOD₅), mg/L[1] Dissolved Oxygen Depletion with nitrification inhibitor		5210 B			
15. Chemical oxygen demand (COD), mg/L; Titrimetric, or	410.1	5220 B	D1252–88	I–3560 or	973.46[3] p. 17.[9]
	410.2 or			I–3562–85	
	410.3				
Spectrophotometric, manual or automated	410.4			I–3561–85	Notes 13 or 14.
16. Chloride, mg/L:					
Titrimetric (silver nitrate)		4500–Cl B	D512–89(B)	I–1183–85	
or (Mercuric nitrate), or	325.3	4500–Cl C	D512–89(A)	I–1184–85	973.51.[3]
Colorimetric, manual or			D512–89(C)	I–1187–85	
Automated (Ferricyanide)	325.1 or 325.2	4500–Cl C		I–2187–85	
17. Chlorine—Total residual, mg/L; Titrimetric:					
Amperometric direct	330.1	4500–Cl D	D1253–76(A)		
Starch end point direct	330.3	4500–Cl B	D1253–76(B) (1985) Part 18.3.		
Back titration either end point[15], or	330.2	4500–Cl C			
DPD–FAS	330.4	4500–Cl F			
Spectrophotometric, DPD	330.5	4500–Cl G			
or Electrode					Note 16.
18. Chromium VI dissolved, mg/L; 0.45 micron filtration followed by:					
AA chelation-extraction, or	218.4	3111 A		I–1232–85	
Colorimetric (Diphenylcarbazide				I–1230–85	3078.[17]
19. Chromium—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	218.1	3111 B	D1687–86(D)	I–3236–85	[3]974.27
AA chelation-extraction	218.3	3111 C			
AA furnace	218.2	3113 B			
ICP[36]	[5]200.7	3120 B			
DCP[36] or			D4190–88		Note 34
Voltametry[11], or			D3557–90C		
Colorimetric (Diphenylcarbazide)		3500–Cr D	D1687–84(A)		
20. Cobalt—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	219.1 or C	3111 B (A or B)	D3558–90	I–3239–85	p. 37.[9]
AA furnace	219.2	3113 B			
ICP, or	200.7[5]	3120 B			
DCP			D4190–88		Note 34.
21. Color platinum cobalt units or dominant wavelength, hue, luminance purity:					
Colorimetric (ADMI), or	110.1	2120 E			Note 18.
(Platinum cobalt), or	110.2	2120 B		I–1250–85	
Spectrophotometric	110.3	2120 C			
22. Copper—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	220.1	3111 B or C	D1688–90 (A or B)	I–3270–85 or I–3271–85.	[3]974.27 [9]p. 37.
AA furnace	220.2	3113 B			
ICP[36]	[5]200.7	3120 B			
DCP[36], or			D4190–88		Note 34.
Colorimetric (Neocuproine), or		3500–Cu D	1688–34		
(Bicinchoninate)		or E	(88)(A)		Note 19.
23. Cyanide—Total, mg/L:					
Manual distillation with $MgCl_2$ followed by		4500–CN–C			
Titrimetric, or		4500–CN–D			p. 22.[9]
Spectrophotometric, manual or	335.2	4500–CN–E	D2036–89(A)	I–3300–85	
Automated[20]	335.3		D2036–89(A)		
24. Cyanide amendable to chlorination, mg/L:					
Manual distillation with $MgCl_2$ followed by titrimetric or Spectrophotometric.	335.1	4500–CN–G	D2036–89(B)		
25. Fluoride—Total, mg/L:					
Manual distillation[4] followed by		4500–F–B			
Electrode, manual or	340.2	4500–F–C	D1179–88(B)		
Automated				I–4327–85	
Colorimetric (SPADNS)	340.1	4500–F–D	D1179–80(A) (1988)		
or Automated complexone	340.3	4500–F–E			
26. Gold—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	231.1	3111 B			
AA furnace, or	231.2				
DCP					Note 34.
27. Hardness—Total, as $CaCO_3$, mg/L:					
Automated colorimetric	130.1				
Titrimetric (EDTA), or Ca plus Mg as their carbonates, by inductively coupled plasma or AA direct aspiration. (See Parameters 13 and 33).	130.2	2340 C	D1126–86 (1990)	I–1338–85	973.52B.[3]
28. Hydrogen ion (pH), pH units:					
Electrometric, measurement, or	150.1	4500–H⁺ B	D1293–84 (A or B) (1990).	I–1586–85	973.41.[3]
Automated electrode					Note 21.
29. Iridium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration or	235.1	3111 B			
AA furnace	235.2				
30. Iron—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	236.1	3111 B or C	D1068–90 (A or B)	I–3381–85	[3]974.27.

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TABLE 1B.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units and methods	Reference (Method No. or Page) EPA [1,35]	Std. method 18th ed.	ASTM	USGS [2]	Other
AA furnace	236.2	3113 B			
ICP [36]	[8]200.7	3120 B			
DCP [36], or					Note 34.
Colorimetric (Phenanthroline)		3500–Fe D	D1068–90(D)		Note 22.
31. Kjeldahl nitrogen—Total, (as N), mg/L; digestion and distillation followed by:		4500–N org B or C	3590–84(A)		
Titration	351.3	4500–NH$_3$ E	D3590–89(A)		973.48.[3]
Nesslerization	351.3	4500–NH$_3$ C	D3590–89(A)		
Electrode	351.3	4500–NH$_3$ F or G			
Automated phenate	351.1	4500–NH$_3$ H		I–4551–78 [8]	
Semi-automated block digestor, or	351.2		D3590–89(B)		
Potentiometric	351.4		D3590–89(A)		
32. Lead—Total [4], mg/L; digestion [4] followed by:					
AA direct aspiration [36]	239.1	3111B or C	D3559–90 (A or B)	I–3399–85	[3]974.27.
AA furnace	239.2	3113 B			
ICP [36]	[8]200.7	3120 B			
DCP [36]			D4190–88		Note 34.
Voltametry [11], or			D3559–90(C)		
Colorimetric (Dithizone)		3500–Pb D			
33. Magnesium—Total [4], mg/L; Digestion [4] followed by:					
AA direct aspiration	242.1	3111 B	D511–88(B)	I–3447–85	974.27.[3]
ICP	200.7 [8]	3120 B			
DCP, or					Note 34.
Gravimetric		3500–mg D	D511–77(A)		
34. Manganese—Total [4], mg/L; digestion [4] followed by:					
AA direct aspiration [36]	243.1	3111 B or C	D858–90 (A or B)	I–3454–85	[3]974.27.
AA furnace	243.2	3113 B			
ICP [36]	[8]200.7	3120 B			
DCP [36], or			D4190–88		Note 34.
Colorimetric (Persulfate), or		3500–Mn D	D858–84(A) (1988)		[3]920.203.
(Periodate)					Note 23.
35. Mercury—Total [4], mg/L:					
Cold vapor, manual or	245.1	3112 B	D3223–86	I–3462–85	977.22.[3]
Automated	245.2				
36. Molybdenum—Total [4], mg/L; Digestion [4] followed by:					
AA direct aspiration	246.1	3111 D		I–3490–85	
AA furnace	246.2	3113 B			
ICP, or	200.7 [8]	3120 B			
DCP					Note 34.
37. Nickel—Total [4], mg/L; digestion [4] followed by:					
AA direct aspiration [36]	249.1	3111B or C	D1886–90 (A or B)	I–3499–85	
AA furnace	249.2	3111 B			
ICP [36]	[8]200.7	3120 B			
DCP [36], or			D4190–88		Note 34
Colorimetric (Heptoxime)		3500–Ni D			
38. Nitrate (as N), mg/L:					
Colorimetric (Brucine sulfate) or Nitrate-nitrite N minus Nitrite N (See parameters 39 and 40)	352.1		D992–71		973.50[3], 419D [17], p. 28.[9]
39. Nitrate-nitrite (as N), mg/L:					
Cadmium reduction, Manual or	353.3	4500–NO$_3$ E	D3867–90(B)		
Automated, or	353.2	4500–NO$_3$ F	D3867–90(A)	I–4545–85	
Automated hydrazine	353.1	4500–NO$_3$ H			
40. Nitrite (as N), mg/L; Spectrophotometric:					
Manual or	354.1	4500–NO$_2$ B	D1254–87		Note 25.
Automated (Diazotization)				I–4540–85	
41. Oil and grease—Total recoverable, mg/L:					
Gravimetric (extraction)	413.1	5520 B			
42. Organic carbon—Total (TOC), mg/L:					
Combustion or oxidation	415.1	5310–B	D2579–85 (A or B)		973.47[3], p. 14.[24]
43. Organic nitrogen (as N), mg/L:					
Total Kjeldahl N (Parameter 31) minus ammonia N (Parameter 4)					
44. Orthophosphate (as P), mg/L; Ascorbic acid method:					
Automated, or	365.1	4500–P F		I–4601–85	973.56.[3]
Manual single reagent, or	365.2	4500–P E	D515–88(A)		973.55.[3]
Manual two reagent	365.3				
45. Osmium—Total [4], mg/L; Digestion [4] followed by:					
AA direct aspiration, or	252.1	3111 D			
AA furnace	252.2				
46. Oxygen dissolved, mg/L:					
Winkler (Azide modification), or	360.2	4500–O C	D888–81(C) (1988)	I–1575–78 [8]	973.45B.[3]
Electrode	360.1	4500–O G		I–1576–78 [8]	
47. Palladium—Total [4], mg/L; Digestion [4] followed by:					
AA direct aspiration, or	253.1	3111 B			p. S27.[10]
AA furnace	253.2				p. S28.[10]
DCP					Note 34.
48. Phenols, mg/L; Manual distillation [26]	420.1		D1783–80 (A or B)		Note 27.
Followed by:					
Colorimetric (4AAP) manual, or	420.1				Note 27.
Automated [19]	420.2				
49. Phosphorus (elemental), mg/L; Gas-liquid chromatography					Note 28.
50. Phosphorus—Total, mg/L:					
Persulfate digestion followed by:	365.2	4500–P–B.5			973.55.[3]
Manual, or	365.2 or 365.3	4500–P–E	D515–88(A)		
Automated ascorbic acid reduction, or	365.1	4500–P–F		I–4600–85	973.56.[3]
Semi-automated block digestor	365.4				
51. Platinum—Total [4], mg/L; Digestion [4] followed by:					
AA direct aspiration	255.1	3111 B			
AA furnace	255.2				
DCP					Note 34.
52. Potassium—total [4], mg/L; Digestion [4] followed by:					
AA direct aspiration	258.1	3111 B		I–3630–85	973.53.[3]
ICP	200.7 [8]				
Flame photometric, or		3500–K D	D1428–82(A)		
Colorimetric (Cobaltinitrite)					317B.[17]

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TABLE 1B.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units and methods	Reference (Method No. or Page) EPA[1,35]	Std. methods 18th ed.	ASTM	USGS[2]	Other
53. Residue—Total, mg/L; Gravimetric, 103–105°	160.3	2540 B		I-3750-85	
54. Residue—filterable, mg/L; Gravimetric, 180°	160	2540-C		I-1750-85	
55. Residue—nonfilterable, (TSS), mg/L; Gravimetric, 103–105° post washing of residue.	160.2	2540-D		I-3765-85	
56. Residue—settleable, mg/L; Volumetric, (Imhoff cone), or gravimetric.	160.5	2540 F			
57. Residue—Volatile, mg/L; Gravimetric, 550°	160.4	2540 E		I-3753-85	
58. Rhodium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration, or	265.1	3111 B			
AA furnace	265.2				
59. Ruthenium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration, or	267.1	3111 B			
AA furnace	267.2				
60. Selenium—Total[4], mg/L; digestion[4] followed by:					
AA furnace	270.2	3113 B			
ICP[36], or	[5]200.7	3120 B			
AA gaseous hydride	270.3	3114 B	D3859-88(A)	I-3667-85	
61. Silica—Dissolved, mg/L; 0.45 micron filtration followed by:					
Colorimetric, Manual or	370.1	4500-Si D	D859-88(B)	I-1700-85	
Automated (Molybdosilicate), or				I-2700-85	
ICP	200.7[5]				
62. Silver—Total[29], mg/L; Digestion[4] followed by:					
AA direct aspiration	272.1	3111 B or C		I-3720-85	973.27[3], p. 37.[9]
AA furnace	72.2	3113 B			
Colorimetric (Dithizone)					319B.[17]
ICP, or	200.7[5]				
DCP					Note 34.
63. Sodium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	273.1	3111 B		I-3735-85	973.54.[3]
ICP	200.7[5]	3120 B			
DCP, or					Note 34.
Flame photometric		3500-Na D	D1428-82(A)		
64. Specific conductance, micromhos/cm at 25°C:					
Wheatstone bridge	120.1	2510 B	D1125-82(A)	I-1780-85	973.40.[3]
65. Sulfate (as SO_4), mg/L:					
Automated colorimetric (barium chloranilate)	375.1				
Gravimetric, or	375.3	4500-SO_4-2 C or D	D516-82(A) (1988)		925.54.[3]
Turbidimetric	375.4		D516-88		426C.[30]
66. Sulfide (as S), mg/L:					
Titrimetric (iodine), or	376.1	4500-S-2 E		I-3840-85	228A.[31]
Colorimetric (methylene blue)	376.2	4500-S-2 D			
67. Sulfite (as SO_3), mg/L:					
Titrimetric (iodine-iodate)	377.1	4500-SO_3-2 B	D1339-84(C)		
68. Surfactants, mg/L:					
Colorimetric (methylene blue)	425.1	5540 C	D2330-88		
69. Temperature,					
C: Thermometric	170.1	2550 B			Note 32.
70. Thallium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	279.1	3111 B			
AA furnace, or	279.2				
ICP	200.7[5]				
71. Tin—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration, or	282.1	3111 B		I-3850-78[8]	
AA furnace	282.2	3113 B			
72. Titanium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	283.1	3111 D			
AA furnace	283.2				
DCP					Note 34.
73. Turbidity, NTU:					
Nephelometric	180.1	2130 B	D1889-88A	I-3860-85	
74. Vanadium—Total[4], mg/L; Digestion[4] followed by:					
AA direct aspiration	286.1	3111 D			
AA furnace	286.2				
ICP	200.7[5]	3120 B			
DCP, or			D4190-88		Note 34
Colorimetric (Gallic acid).		3500-V D	D3373-84(A) (1988)		
75. Zinc—Total[4], mg/L; digestion[4] followed by:					
AA direct aspiration[36]	289.1	3111 (B or C)	D1691-90 (A or B)	I-3900-85	[3]974.27, [6]p. 37.
AA furnace	289.2				
ICP[36]	[5]200.7	3120 b			
DCP[36], or			D4190-88		Note 34.
Colorimetric (Dithizone) or		3500-Zn E			
(Zincon)		3500-Zn F			Note 33.

Table 1B notes:

[1] "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory-Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable.

[2] Fishman, M. J., et al, "Methods for Analysis of Inorganic Substances in Water and Fluvial Sediments," U.S. Department of the Interior, Techniques of Water—Resource Investigations of the U.S. Geological Survey, Denver, CO, Revised 1989, unless otherwise stated.

[3] "Official Methods of Analysis of the Association of Official Analytical Chemists," methods manual, 15th ed. (1990).

[4] For the determination of total metals the sample is not filtered before processing. A digestion procedure is required to solubilize suspended material and to destroy possible organic-metal complexes. Two digestion procedures are given in "Methods for Chemical Analysis of Water and Wastes, 1979 and 1983." One (section 4.1.3), is a vigorous digestion using nitric acid. A less vigorous digestion using nitric and hydrochloric acids (section 4.1.4) is preferred; however, the analyst should be cautioned that this mild digestion may not suffice for all samples types. Particularly, if a colorimetric procedure is to be employed, it is necessary to ensure that all organo-metallic bonds be broken so that the metal is in a reactive state. In those situations, the vigorous digestion is to be preferred making certain that at no time does the sample go to dryness. Samples containing large amounts of organic materials would also benefit by this vigorous digestion. Use of the graphite furnace technique, inductively coupled plasma, as well as determinations for certain elements such as arsenic, the noble metals, mercury, selenium, and titanium require a modified digestion and in all cases the method write-up should be consulted for specific instruction and/or cautions.Note: If the digestion included in one of the other approved references is different than the above, the EPA procedure must be used.NOTE: If the digestion included in one of the other approved references is different than the above, the EPA procedure must be used.

Dissolved metals are defined as those constituents which will pass through a 0.45 micron membrane filter. Following filtration of the sample, the referenced procedure for total metals must be followed. Sample digestion of the filtrate for dissolved metals, (or digestion of the original sample solution for total metals) may be omitted for AA (direct aspiration or graphite furnace) and ICP analyses provided the sample solution to be analyzed meets the following criteria:

a. has a low COD (<20)

b. is visibly transparent with a turbidity measurement of 1 NTU or less

c. is colorless with no perceptible odor, and

d. is of one liquid phase and free of particulate or suspended matter following acidification.

[5] The full text of Method 200.7, "Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes," is given at appendix C of this part 136.

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TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter No./name	Container[1]	Preservation[2,3]	Maximum holding time[4]
Table IA—Bacterial Tests:			
1–4. Coliform, fecal and total	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	6 hours.
5. Fecal streptococci	P, G	....do	Do.
Table IB—Inorganic Tests:			
1. Acidity	P, G	Cool, 4°C	14 days.
2. Alkalinity	P, G	....do	Do.
4. Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
9. Biochemical oxygen demand	P, G	Cool, 4°C	48 hours.
11. Bromide	P, G	None required	28 days.
14. Biochemical oxygen demand, carbonaceous.	P, G	Cool, 4°C	48 hours.
15. Chemical oxygen demand	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
16. Chloride	P, G	None required	Do.
17. Chlorine, total residual	P, G	....do	Analyze immediately.
21. Color	P, G	Cool, 4°C	48 hours.
23–24. Cyanide, total and amenable to chlorination.	P, G	Cool, 4°C, NaOH to pH>12, 0.6g ascorbic acid[5].	14 days.[6]
25. Fluoride	P	None required	28 days.
27. Hardness	P, G	HNO_3 to pH<2, H_2SO_4 to pH<2	6 months.
28. Hydrogen ion (pH)	P, G	None required	Analyze immediately.
31, 43. Kjeldahl and organic nitrogen	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Metals:[7]			
18. Chromium VI	P, G	Cool, 4°C	24 hours.
35. Mercury	P, G	HNO_3 to pH<2	28 days.
3, 5–8, 10, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70–72, 74, 75. Metals, except chromium VI and mercury.	P, G	....do	6 months.
38. Nitrate	P, G	Cool, 4°C	48 hours.
39. Nitrate-nitrite	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
40. Nitrite	P, G	Cool, 4°C	48 hours.
41. Oil and grease	G	Cool to 4°C, HCl or H_2SO_4 to pH<2.	28 days.
42. Organic carbon	P, G	Cool, 4°C, HCl or H_2SO_4 to pH<2.	Do.
44. Orthophosphate	P, G	Filter immediately, Cool, 4°C	48 hours.
46. Oxygen, Dissolved Probe	G Bottle and top.	None required	Analyze immediately.
47. Winkler	....do	Fix on site and store in dark	8 hours.
48. Phenols	G only	Cool, 4°C, H_2SO_4 to pH<2	28 days.
49. Phosphorus (elemental)	G	Cool, 4°C	48 hours.
50. Phosphorus, total	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
53. Residue, total	P, G	Cool, 4°C	7 days.
54. Residue, Filterable	P, G	....do	7 days.
55. Residue, Nonfilterable (TSS)	P, G	....do	7 days.
56. Residue, Settleable	P, G	....do	48 hours.
57. Residue, volatile	P, G	....do	7 days.
61. Silica	P	....do	28 days.
64. Specific conductance	P, G	....do	Do.
65. Sulfate	P, G	....do	Do.
66. Sulfide	P, G	Cool, 4°C add zinc acetate plus sodium hydroxide to pH>9.	7 days.
67. Sulfite	P, G	None required	Analyze immediately.
68. Surfactants	P, G	Cool, 4°C	48 hours.
69. Temperature	P, G	None required	Analyze.
73. Turbidity	P, G	Cool, 4°C	48 hours.

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TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter No./name	Container [1]	Preservation [2,3]	Maximum holding time [4]
Table IC—Organic Tests.[8]			
13, 18–20, 22, 24–28, 34–37, 39–43, 45–47, 56, 66, 88, 89, 92–95, 97. Purgeable Halocarbons.	G, Teflon-lined septum.	Cool, 4°C, 0.008% $Na_2S_2O_3$.[5]	14 days.
6, 57, 90. Purgeable aromatic hydrocarbons	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5], HC1 to pH2[9].	Do.
3, 4, Acrolein and acrylonitrile	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]; Adjust pH to 4–5[10].	Do.
23, 30, 44, 49, 53, 67, 70, 71, 83, 85, 96. Phenols[11].	G, Teflon-lined cap.	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction.
7, 38. Benzidines[11]	do	do	7 days until extraction.[13]
14, 17, 48, 50–52. Phthalate esters[11]	do	Cool, 4°C	7 days until extraction; 40 days after extraction.
72–74. Nitrosamines[11,14]	do	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$[5].	Do.
76–82. PCBs[11] acrylonitrile	do	Cool, 4°C	Do.
54, 55, 65, 69. Nitroaromatics and isophorone[11].	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5] store in dark.	Do.
1, 2, 5, 8–12, 32, 33, 58, 59, 64, 68, 84, 86. Polynuclear aromatic hydrocarbons.[11].	do	do	Do.
15, 16, 21, 31, 75. Haloethers[11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	Do.
29, 35–37, 60–63, 91. Chlorinated hydrocarbons[11].	do	Cool, 4°C	Do.
87. TCDD[11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	Do.
Table ID—Pesticides Tests:			
1–70. Pesticides[11]	do	Cool, 4°C, pH 5–9[15]	Do.
Table IE—Radiological Tests:			
1–5. Alpha, beta and radium	P, G	HNO_3 to pH<2	6 months.

Table II Notes

[1] Polyethylene (P) or Glass (G).

[2] Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

[3] When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

[4] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See § 136.3(e) for details.

[5] Should only be used in the presence of residual chlorine.

[6] Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

I, the Project Officer, agree and assure that the above circled parameters and methods will be used for this project. Any changes/deviations will first be submitted to Joel Simpkins of NJDEP with a new title page for signatures of approval.

Project Officer Signature — Date: 7/24/97

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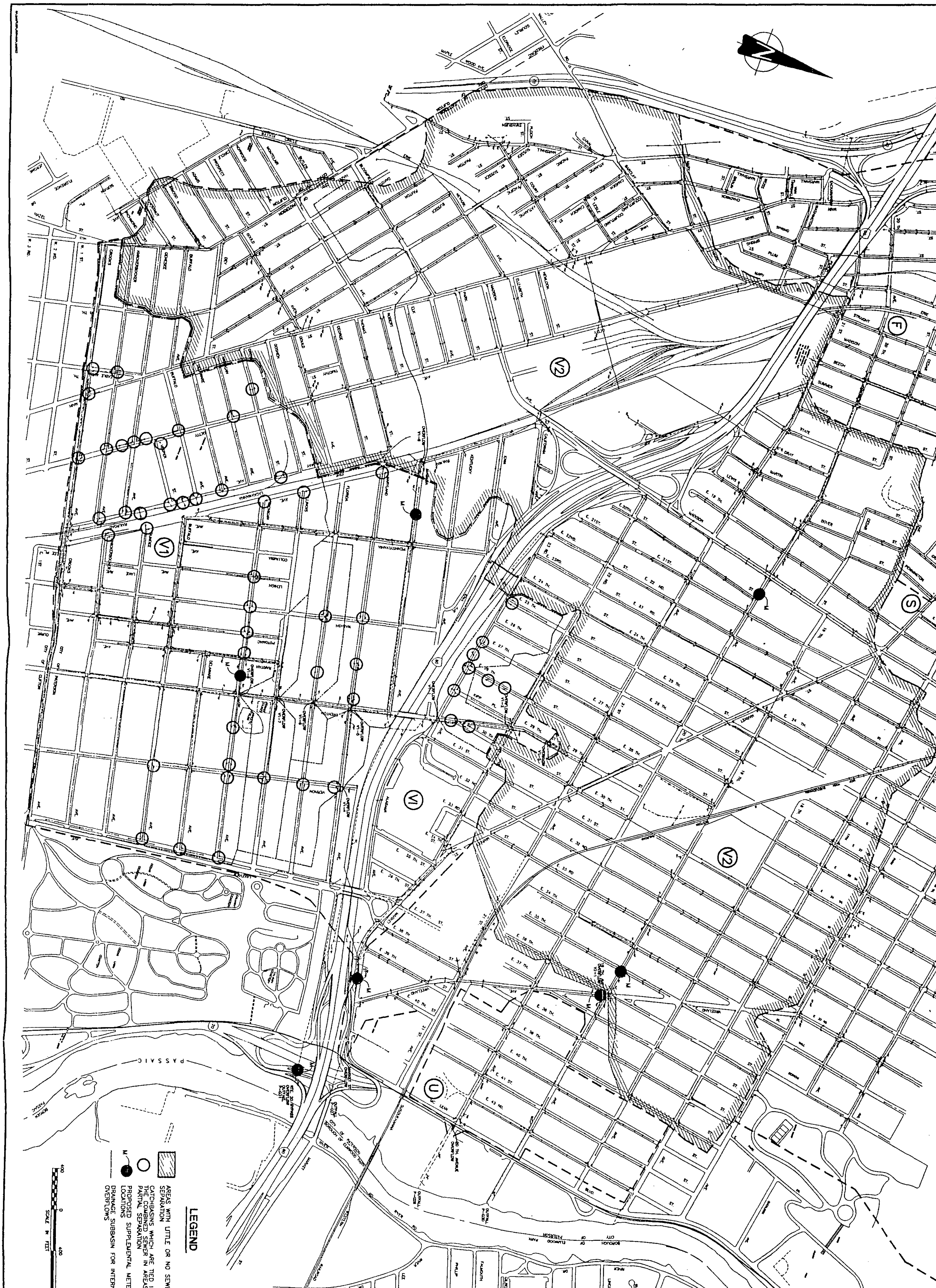


Job 261600 TASK 1	CITY OF PATERSON PASSAIC COUNTY, NEW JERSEY COMBINED SEWER OVERFLOW STUDY DRAINAGE AREA V1 & V2	Killam Associates Consulting Engineers 27 Bleeker Street Millburn, New Jersey 07041	JOHN S. ROLAK, JR. Professional Engineer - N.J. Lic. No. 29108 Date
No. PLATE A B/O Total			

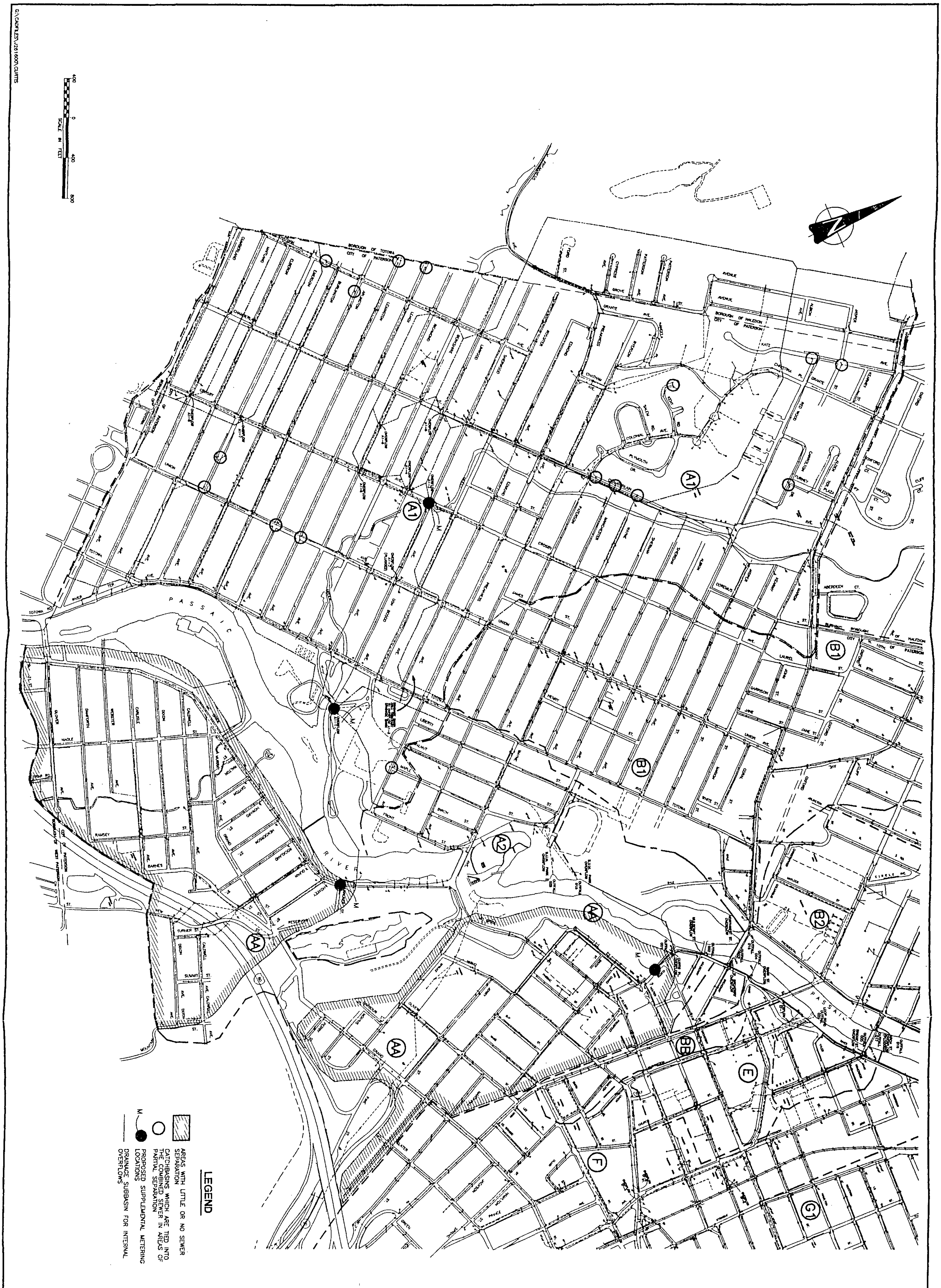
Designed	Drawn	Checked	Approved	Date	Date	Revision
JSR	GS	JSR	JSR	7-25-97		

Killam Associates

Contract No.

Print Date

946210068



Job 261600 TASK 1	CITY OF PATERSON PASSAIC COUNTY, NEW JERSEY COMBINED SEWER OVERFLOW STUDY DRAINAGE AREA A	Killam Associates ▫ Consulting Engineers 27 Bleeker Street Millburn, New Jersey 07041
No. PLATE B		
B/O	Total 8	

JOHN S. ROLAK, JR.
Professional Engineer – N.J. Lic. No. 29108

Date

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JSR	CS	JSR	JSR	7-25-97

Date	Revision

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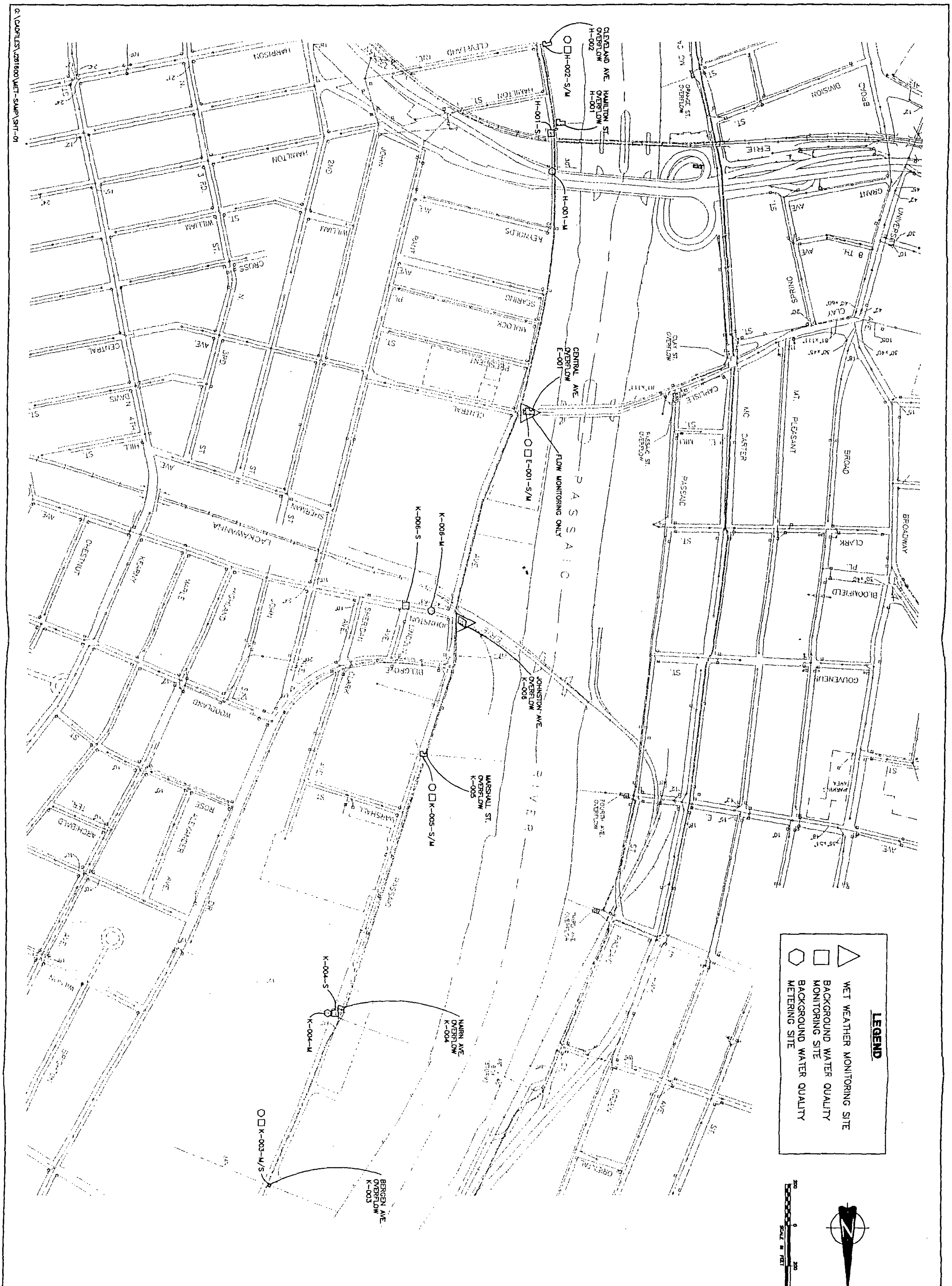

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Contract No.

Job	No.					
281600 TASK 07	PLATE 1	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	Killam Associates Consulting Engineers 27 Bleeker Street Millburn, New Jersey 07041	JOHN S. ROLAK, JR. Professional Engineer - N.J. Lic. No. 29108 Date	Date	Revision

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RJS	GS	JSR	JSR	1-27-97

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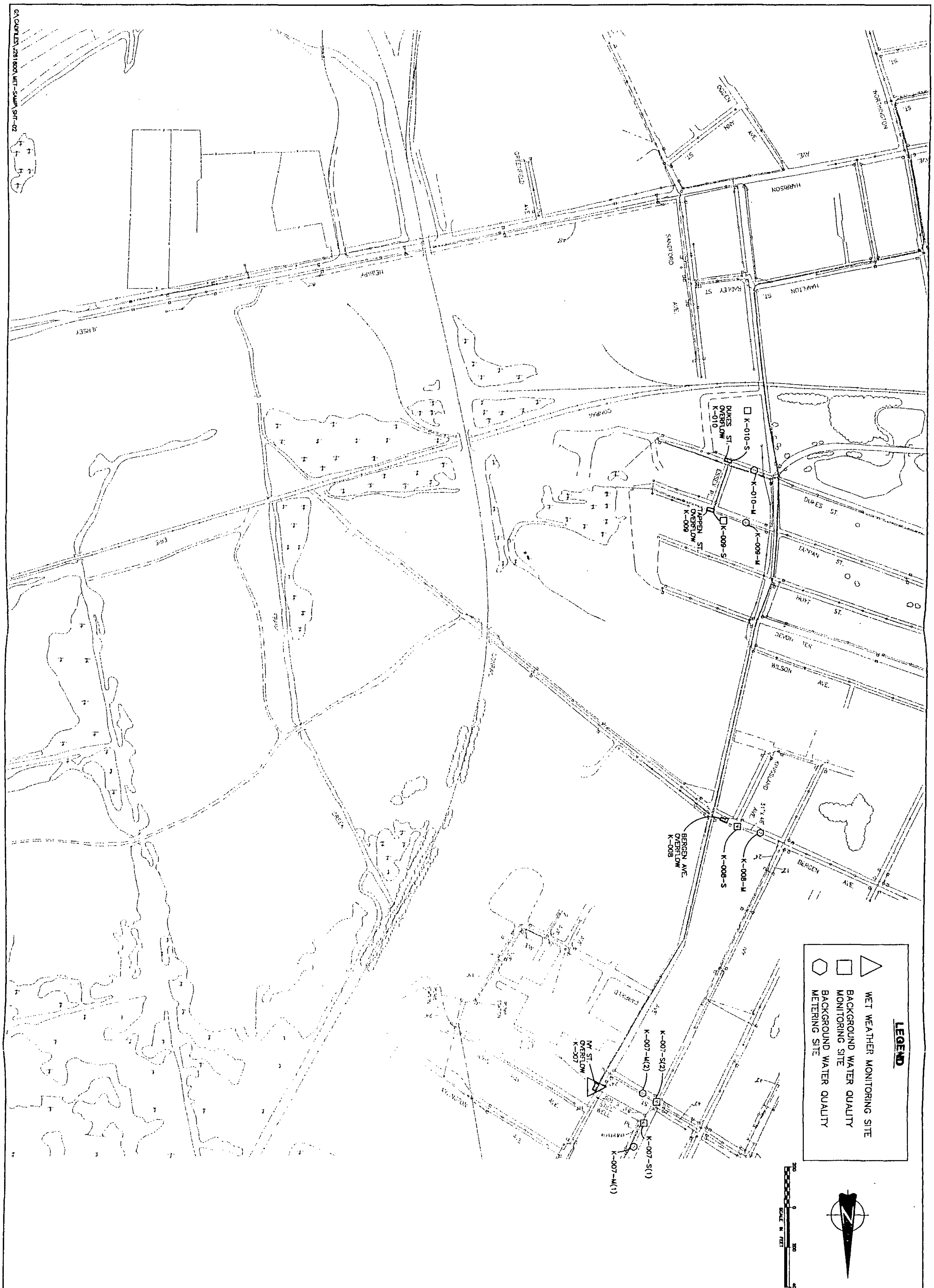

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Job 281500 TASK 07	No. PLATE 2	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON **COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY** **PROPOSED METERING AND WATER QUALITY MONITORING SITES**	Killam Associates Consulting Engineers 27 Bleeker Street Millburn, New Jersey 07041	JOHN B. ROLAK, JR. Professional Engineer – N.J. Lic. No. 29108 Date

Designed	Drawn	Checked	Approved	Date	Date	Revision
RJS	GS	JSR	JSR	1-27-97		

Contract No.

Print Date

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Job	PASSAIC VALLEY SEWERAGE COMMISSIONERS	Killam Associates Consulting Engineers	JOHN S. ROLAK, JR. Professional Engineer - N.J. Lic. No. 29108						
261600 TASK 07	COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON		Date						
No. PLATE 3	COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	27 Bleeker Street Millburn, New Jersey 07041	Designed RJS	Drawn GS	Checked JSR	Approved JSR	Date 1-27-97	Date	Revision

Contract No.

Print Date

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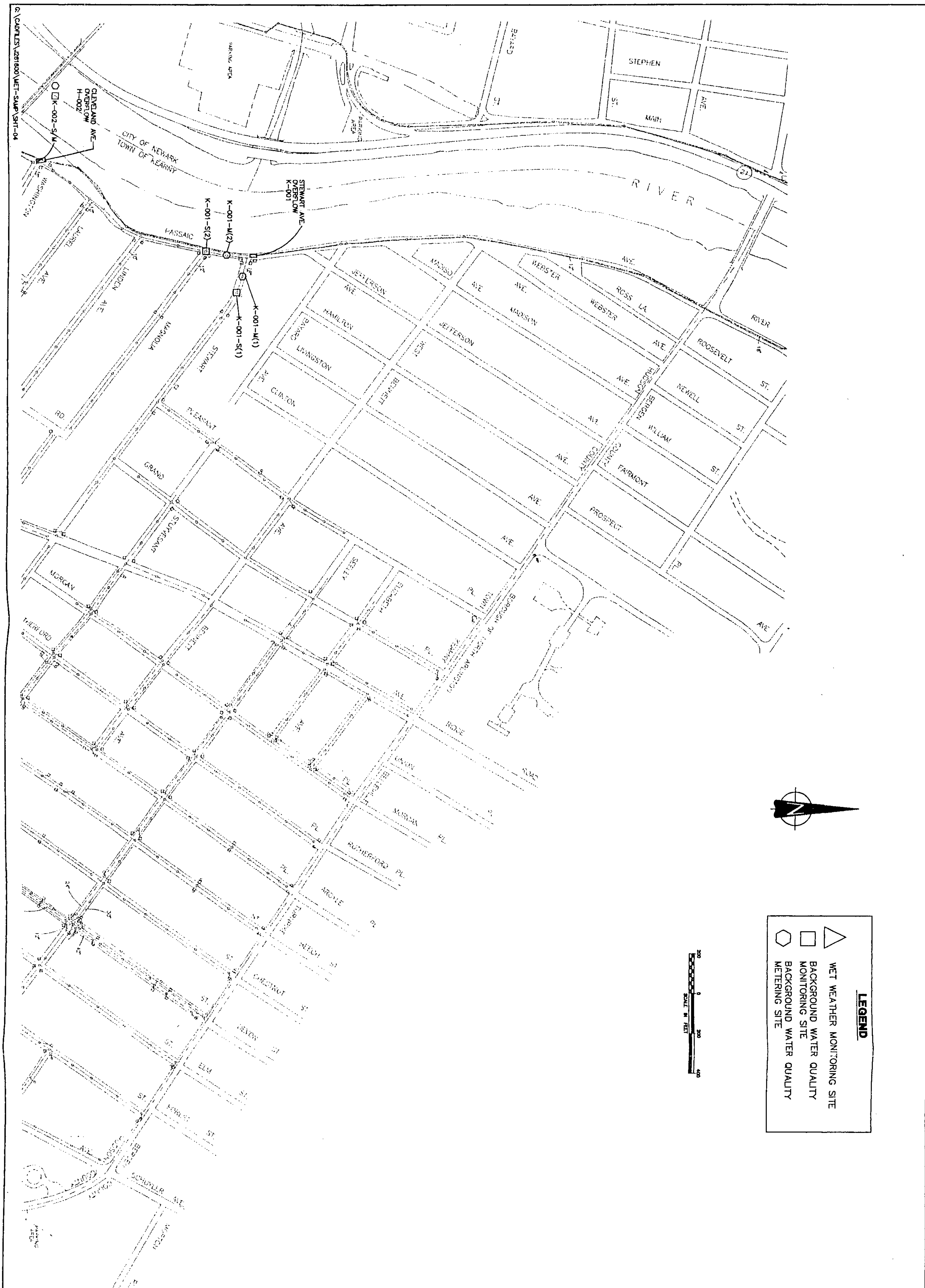

Job 281600 TASK 07	No. PLATE 4	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	Killam Associates Consulting Engineers 27 Bleeker Street Millburn, New Jersey 07041	JOHN S. ROLAK, JR. Professional Engineer – N.J. Lic. No. 29108 Date

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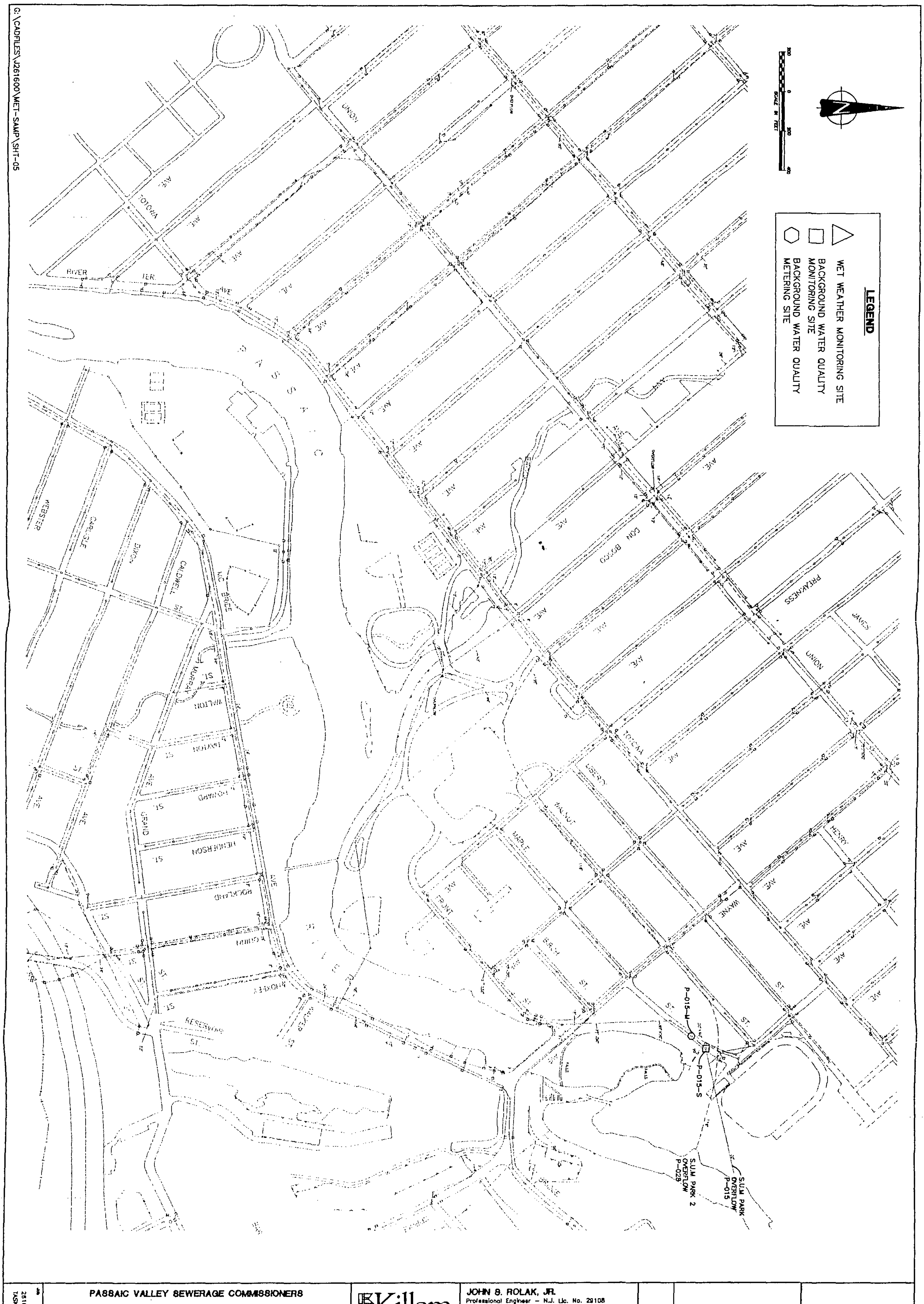

Job 261600 TASK 07	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	Killam Associates Consulting Engineers 27 Bleeker Street Millburn, New Jersey 07041	JOHN S. ROLAK, JR. Professional Engineer – N.J. Lic. No. 29108 Date	
No. PLATE 5 5/9 Total			Designed RJS · Drawn GS · Checked JSR · Approved JSR · Date 1-27-97	Date · Revision

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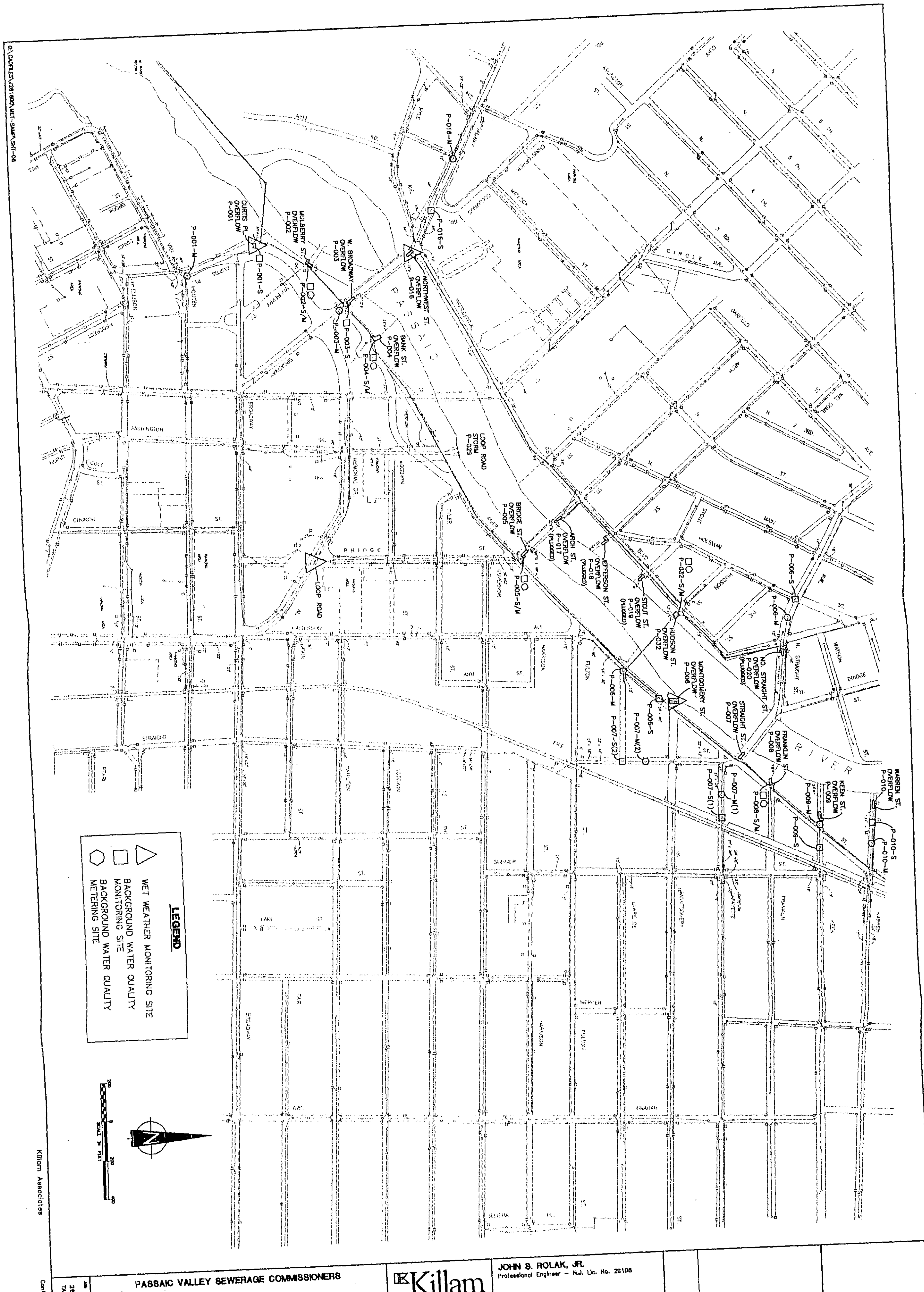

Job No. 261600 Task 07	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	Killam Associates Consulting Engineers 27 Bleeker Street Millburn, New Jersey 07041	JOHN S. ROLAK, JR. Professional Engineer – N.J. Lic. No. 29106 Date				
PLATE 8			Designed RJS	Drawn GS	Checked JSR	Approved JSR	Date 1-27-97

Contract No.

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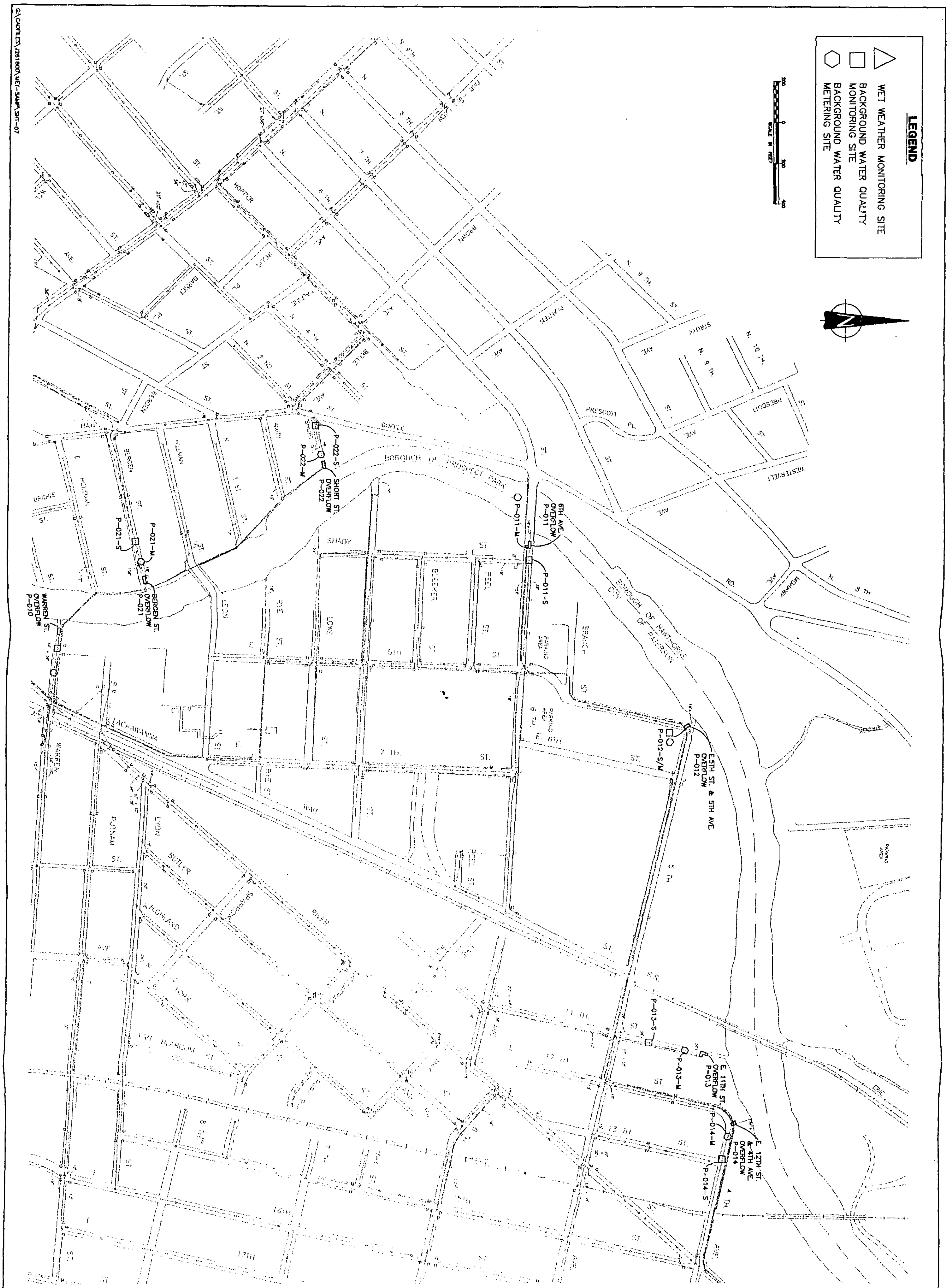

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Job 281800 TASK 07	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON	Killam Associates Consulting Engineers	JOHN S. ROLAK, JR. Professional Engineer – N.J. Lic. No. 29108 Date
No. PLATE 7	COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	27 Bleeker Street Millburn, New Jersey 07041	Designed RJS · Drawn GS · Checked JSR · Approved JSR · Date 1-27-97

Date	Revision

Contract No.

Print Date

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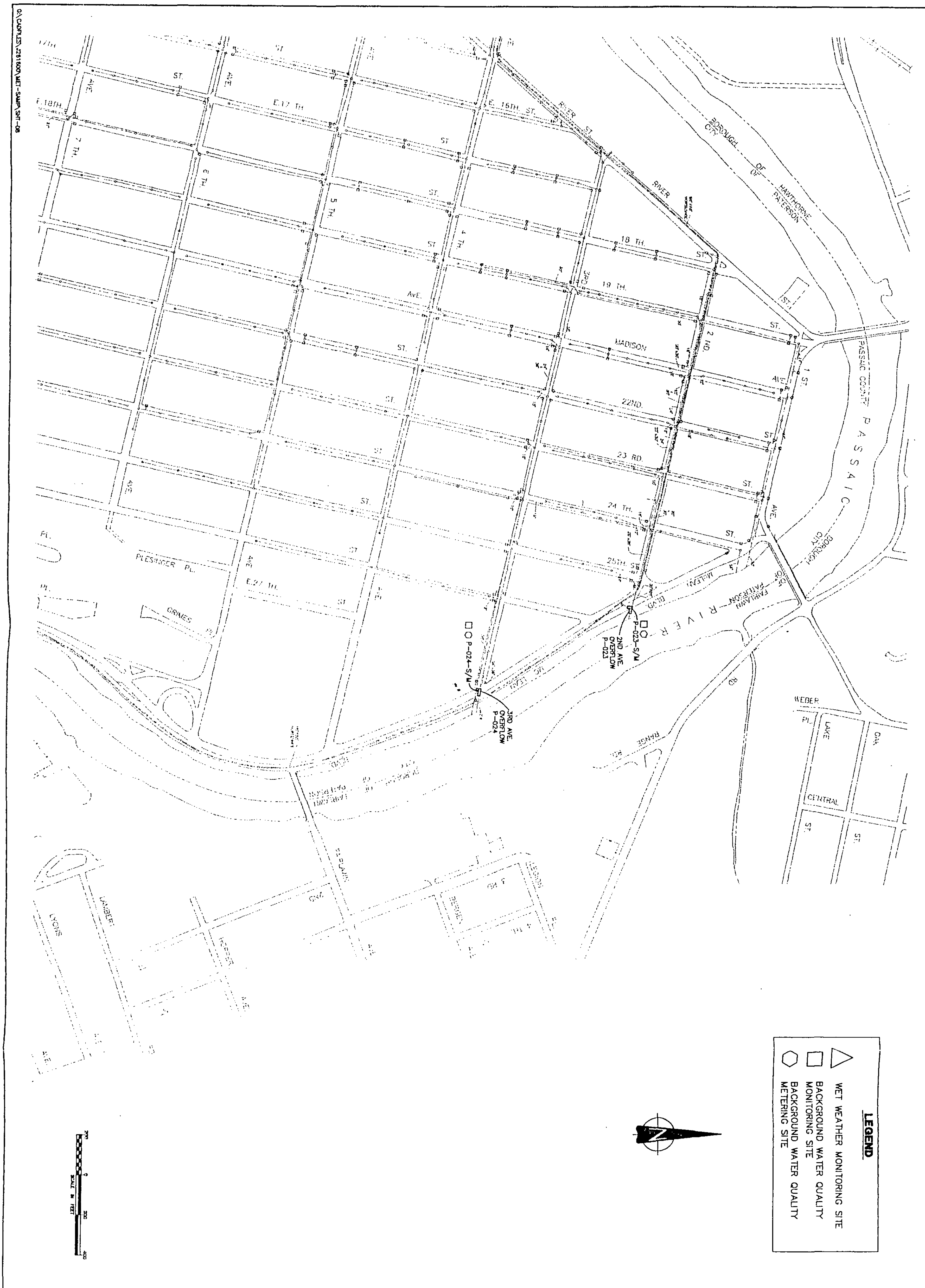

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Job	281600 TASK 07	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON	Killam Associates Consulting Engineers	JOHN S. ROLAK, JR. Professional Engineer – N.J. Lic. No. 29108 Date
No.	PLATE 8	COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	27 Bleeker Street Millburn, New Jersey 07041	Designed RJS · Drawn GS · Checked JSR · Approved JSR · Date 1-27-97

Date	Revision

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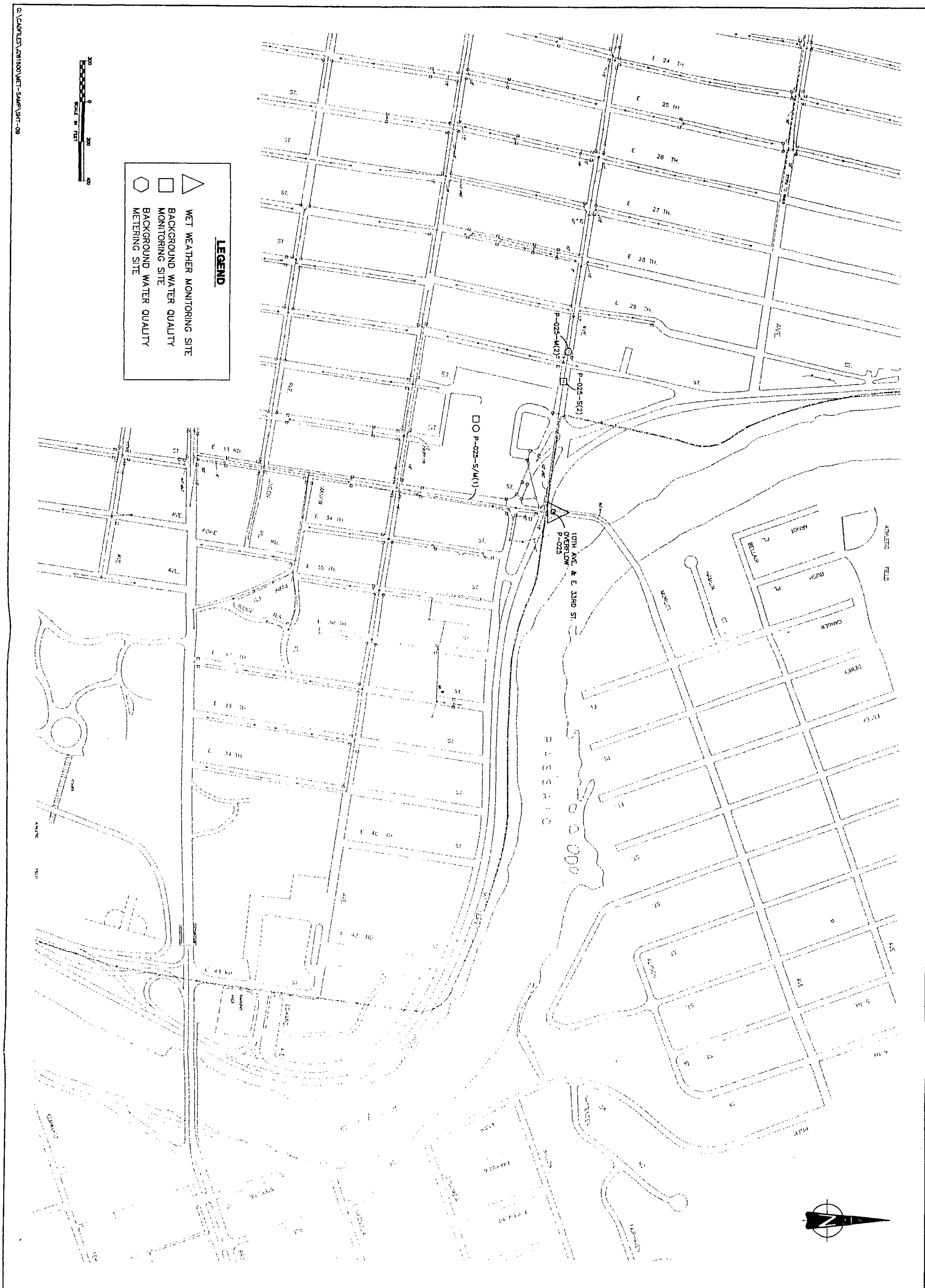

Job	261600 TASK 07	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON	Killam Associates Consulting Engineers	JOHN S. ROLAK, JR. Professional Engineer - N.J. Lic. No. 29108 Date		
No.	PLATE 9	**COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY** **PROPOSED METERING AND WATER QUALITY MONITORING SITES**	27 Bleeker Street Millburn, New Jersey 07041	Designed RJS / Drawn GS / Checked JSR / Approved JSR / Date 1-27-97	Date	Revision

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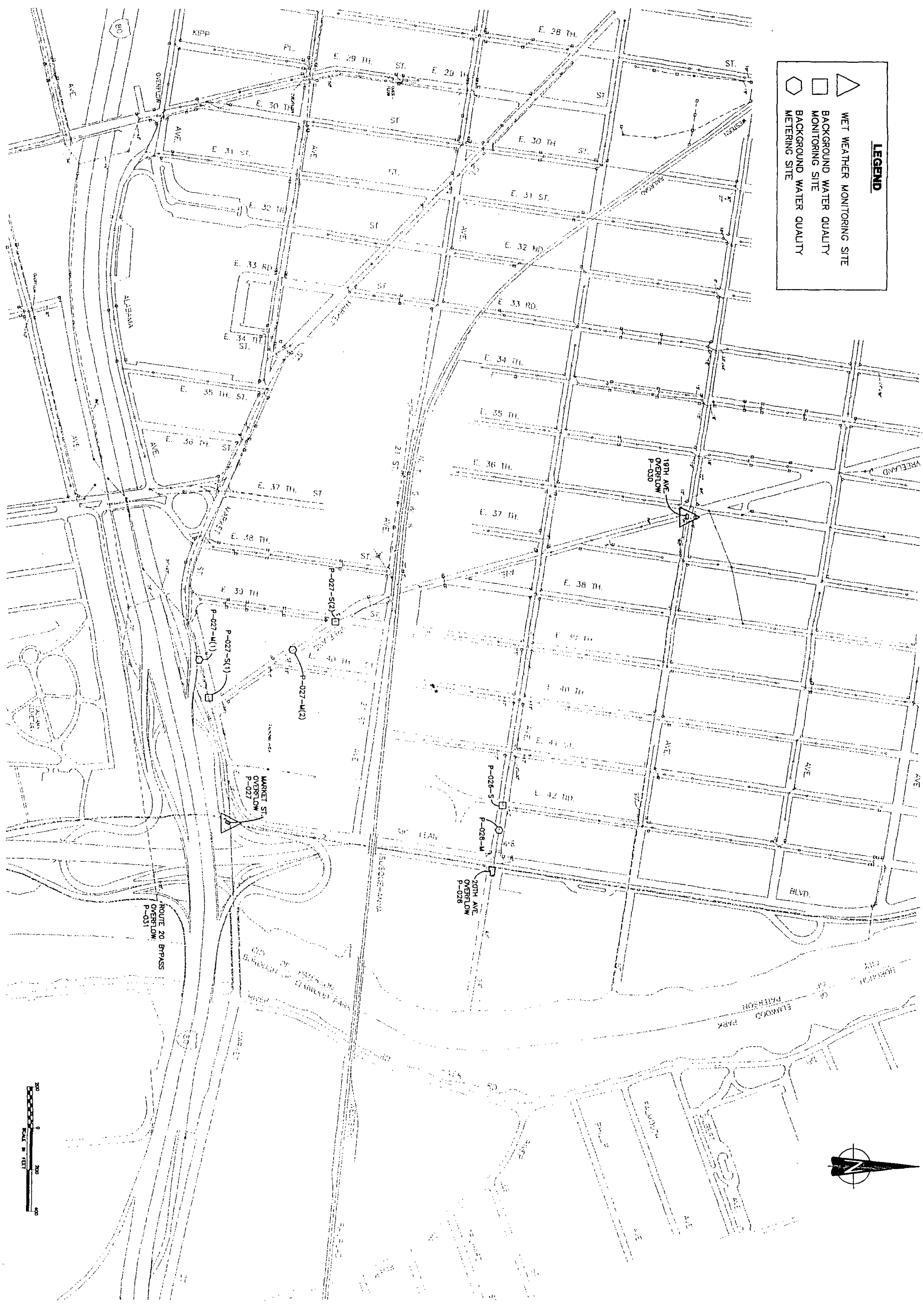

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Contract No.	Job 281600 TASK 07	PASSAIC VALLEY SEWERAGE COMMISSIONERS COMBINED SEWER SYSTEMS FOR EAST NEWARK, HARRISON, KEARNY, AND PATERSON	Killam Associates Consulting Engineers	JOHN S. ROLAK, JR. Professional Engineer – N.J. Lic. No. 29108 Date
	No. PLATE 10	COMBINED SEWER OVERFLOW CHARACTERIZATION STUDY PROPOSED METERING AND WATER QUALITY MONITORING SITES	27 Bleeker Street Millburn, New Jersey 07041	Designed RJS / Drawn GS / Checked JSR / Approved JSR / Date 1-27-97

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